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14 April 1999

CALFED Bay-Delta Program Office
1416 Ninth Street, Suite 1155
Sacramento, California 95814

Dear Colleague:

Research Proposal in support of Project Entitled
"Impacts of Dietary Selenium on Giant Garter Snake
Populations in Sacramento-San Joaquin Watershed"
Principal Investigator - Marti Wolfe

It is our pleasure to present for your consideration the referenced proposal in response to the Ecosystem Restoration Projects and Programs February 1999 Proposal Solicitation Package.

For the purposes of determining applicant category, it is our understanding that The Regents of the University of California will be classified under the "State" category. Hence, any resulting awards shall only include the terms and conditions identified in Attachment D of the 1999 Proposal Solicitation Package as "Terms and Conditions for State (CALFED) Funds" and "Standard Clauses-Interagency Agreements".

The University hereby takes exception to clauses pertaining to Substitution, Rights in Data and Indemnification as detailed in Attachment D. On behalf of The Regents of the University of California, we hereby reserve the right to negotiate said clauses as detailed in the Proposal Solicitation Package should this proposal result in a subsequent award.

Please call on the principal investigator for scientific information. Please direct any contract-related or administrative questions to me or to my assistant Ms. Charlene Wilm by telephone, facsimile or electronic mail at the numbers specified above. We request that correspondence pertaining to this proposal and a subsequent award be sent to the Office of Research and to the principal investigator.

Sincerely,

Fay Yee
Contracts and Grants Analyst

Enclosures

c: M.F. Wolfe

4.5 PSP Cover Sheet (Attach to the front of each proposal)

Proposal Title: Impacts of Dietary Selenium on Giant Garter Snake Populations in Sacramento-San Joaquin Watershed
Applicant Name: The Regents of the University of California
Mailing Address: OVCR, One Shields Avenue, Davis, CA 95616
Telephone: (530) 752-2075
Fax: (530) 752-5432
Email: vcresearch@ucdavis.edu or mfwolfe@ucdavis.edu

Amount of funding requested: \$526,083 for 3 years.

Indicate the Topic for which you are applying (check only one box).

- | | |
|--|---|
| <input type="checkbox"/> Fish Passage/Fish Screens | <input type="checkbox"/> Introduced Species |
| <input type="checkbox"/> Habitat Restoration | <input type="checkbox"/> Fish Management/Hatchery |
| <input type="checkbox"/> Local Watershed Stewardship | <input type="checkbox"/> Environmental Education |
| <input checked="" type="checkbox"/> Water Quality | |

Does the proposal address a specified Focused Action? X yes no

Perform toxicity testing, identify toxic agents in toxic samples (e.g. Toxic Identification Evaluation), and develop toxicity testing methods using Delta species.

What county or counties is the project located in? Merced County

Indicate the geographic area of your proposal (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> Sacramento River Mainstem | <input type="checkbox"/> East Side Trib: _____ |
| <input type="checkbox"/> Sacramento Trib: _____ | <input type="checkbox"/> Suisun Marsh and Bay |
| <input checked="" type="checkbox"/> San Joaquin River Mainstem | <input type="checkbox"/> North Bay/South Bay: _____ |
| <input type="checkbox"/> San Joaquin Trib: _____ | <input type="checkbox"/> Landscape (entire Bay-Delta watershed) |
| <input type="checkbox"/> Delta: _____ | <input type="checkbox"/> Landscape (entire Bay-Delta watershed) |

Indicate the primary species which the proposal addresses (check all that apply):

- | | |
|--|--|
| <input type="checkbox"/> San Joaquin and East-side Delta tributaries fall-run chinook salmon | <input type="checkbox"/> Spring-run chinook salmon |
| <input type="checkbox"/> Winter-run chinook salmon | <input type="checkbox"/> Fall-run chinook salmon |
| <input type="checkbox"/> Late-fall run chinook salmon | <input type="checkbox"/> Longfin smelt |
| <input type="checkbox"/> Delta smelt | <input type="checkbox"/> Steelhead trout |
| <input type="checkbox"/> Splittail | <input type="checkbox"/> Striped bass |
| <input type="checkbox"/> Green sturgeon | <input type="checkbox"/> All chinook species |
| <input type="checkbox"/> Migratory birds | <input type="checkbox"/> All anadromous salmonids |
| <input checked="" type="checkbox"/> Other: <u>Giant Garter Snake</u> | |

Specify the ERP strategic object and target(s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

The primary ERP Strategic Objective supported by this project is stated in Volume I on page 320:

The Strategic Objective is to restore populations of giant garter snakes to its historical range.

An additional ERP Strategic Objective supported by this project is stated in Volume I on page 209:

The Strategic Objective is to restore the Sacramento splittail to the Delta, Suisun Bay, and the Central Valley. In addition, this project supports a Water Quality Priority Action stated in Volume I on page 8-17: Reduce selenium concentrations in biota to levels below ecological risk guidelines.

Focused Action supported: Water Quality - Sacramento River, San Joaquin River and the Delta.

Perform toxicity testing, identify toxic agents in toxic samples and develop toxicity testing methods using Delta species. RFP page 24

Indicate the type of applicant (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> State agency | <input type="checkbox"/> Federal agency |
| <input type="checkbox"/> Public/Non-profit joint venture | <input type="checkbox"/> Non-profit |
| <input type="checkbox"/> Local government/district | <input type="checkbox"/> Private party |
| <input checked="" type="checkbox"/> University | <input type="checkbox"/> Other: _____ |

Indicate the type of project (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> Planning | <input type="checkbox"/> Implementation |
| <input type="checkbox"/> Monitoring | <input type="checkbox"/> Education |
| <input checked="" type="checkbox"/> Research | |

By signing below, the applicant declares the following:

- 1.) The truthfulness of all representations in their proposal;
- 2.) The individual signing the form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or organization); and
- 3.) The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

**THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA**

Printed name of applicant

Signature of applicant

APR 14 1999

Fay Yee

Contract & Grant Analyst
ffyee@ucdavis.edu

TITLE PAGE

Proposal to:

CALFED Bay-Delta Program Office
1416 Ninth Street, Suite 1155
Sacramento, California 95814

Submitting Organization:

The Regents of the University of California
University of California
Davis, California 95616

Title of Proposed Research:

Impacts of Dietary Selenium on Giant Garter Snake Populations in the
Sacramento-San Joaquin Watershed

Principal Investigator Contact Information:

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Participants and Collaborators:

PI – Marti F. Wolfe
Bill Beckon, U.S. Fish & Wildlife Services (Subcontractor)
Swee Teh, Consultant, University of California, Davis

Type of Organization and Tax Status:

State Controlled Institution of Higher Learning
Tax Exempt under Section 501(c)(3) of the Internal Revenue Code

Tax ID Number:

94-6036494-W

IMPACTS OF DIETARY SELENIUM ON GIANT GARTER SNAKE POPULATIONS IN THE SACRAMENTO-SAN JOAQUIN WATERSHED

EXECUTIVE SUMMARY

Focused Action supported: Water Quality Sacramento River, San Joaquin River and the Delta. *Perform toxicity testing, identify toxic agents in toxic samples and develop toxicity testing methods using Delta species.*

Primary ERP Strategic Objective supported: To restore populations of giant garter snakes to its historical range.

Water Quality Priority Action supported: Reduce selenium concentrations in biota to levels below ecological risk guidelines.

Additional ERP Strategic Objective supported: To restore the Sacramento splittail to the Delta, Suisun Bay, and the Central Valley

Background and Justification:

The historic range of the giant garter snake *Thamnophis gigas* is restricted to the Central Valley of California. The giant garter snake was federally listed as threatened after populations in the San Joaquin Valley disappeared in the 1980's. Selenium contamination in this area may have contributed to its decline and may be limiting efforts to recover the species (Figure 1).

The Ecosystem Restoration Plan Vision for the giant garter snakes is to assist in their recovery and thereby reduce the conflict between protection for the giant garter snake and other beneficial uses of land and water within its range.

Because of much of giant garter snake's historic habitat has been lost, and much that remains has been fragmented, agricultural land and irrigation water now comprise important replacement habitat for giant garter snakes. However, agricultural practices such as irrigation and pesticide application may also degrade habitat quality or otherwise pose a threat to the species.

A Priority Action for the CALFED Water Quality – Selenium program is to "reduce selenium concentrations in biota to levels below ecological risks guidelines".

The proposed project supports both of those goals, and will, as a secondary benefit, help to achieve restoration goals for the splittail, where its range is co-extensive with the giant garter snakes'. Third, this project will contribute to an understanding of the *mechanism* of selenium toxicity, knowledge that is essential to understanding the difference in selenium risk between species, and finally, will help in understanding *selenium bioavailability*.

The Giant Garter Snake Recovery Plan recommends a study of the effects of contaminants on giant garter snakes (USFWS 1998). The objective of the proposed study is to determine the effects of dietary selenium, via a controlled feeding study, on the health and reproductive success of captive common garter snakes (*Thamnophis sirtalis*) as a surrogate test species, to identify non-lethal biomarkers suitable for monitoring selenium exposure and effect on giant garter snake populations, and to field-validate laboratory findings in free-living populations of common garter snakes and Sierra/aquatic garter snakes (*Thamnophis couchii*).

Selenium contamination is suspected as contributing to the decline of giant garter snake populations because of its documented toxic impacts on breeding populations of fish and other aquatic organisms, and on birds (Eisler 1986, Heinz 1996, Hoffman et al. 1988b, Lemly 1996b, Ohlendorf et al. 1986, Ohlendorf et al. 1988a, Ohlendorf et al. 1988b, Saiki and Jennings 1992, Saiki and Lowe 1987). Selenium concentrations above toxicity thresholds have been found in giant garter snakes' prey: Whole body selenium concentrations in mosquitofish (*Gambusia*

affinis) were 29.7 µg/g at Kesterson, compared with 0.32 µg/g at Volta (Saiki and Lowe 1987). In other sites within giant garter snake range (the San Joaquin River and in various tributaries south of Los Banos) reported selenium concentrations in bluegill range from 0.11 to 1.32 µg/g; and in carp (*Cyprinus carpio*) 0.14 to 1.07 µg/g (Saiki and Lowe 1987).

Selenium concentrations in shallow ground water and agricultural drainwater reach toxic levels in a major portion of the historic range of the giant garter snake: the western side of the San Joaquin valley. Selenium concentrations above 2 µg/L are a threat to ecosystems, yet selenium concentrations reach more than 200 µg/l in shallow groundwater southeast of Los Banos (Figure 1). To address the problem of shallow ground water, farmers in the area have installed subsurface drainage systems under their fields. Highly seleniferous drainwater from these drainage systems flows into sloughs historically inhabited by giant garter snakes in the Grasslands area north and northwest of Los Banos.

The ERP acknowledges the difficulty of regulating selenium based on water concentrations alone "Water levels of selenium are useful guidelines for risk management only to the extent that they protect aquatic food chains from excessive bioaccumulation of selenium". The selenium Approach to Solution includes, under Information Needed, "Monitoring efforts to document improvement in the estuary from reduced selenium loadings should be continued and refined".

This project will help to fill that need.

Strategy

We propose a three-phase approach:

First, a subchronic dietary exposure of adult common garter snakes will determine if selenium concentrations in giant garter snakes prey in the wild are sufficient to cause deleterious effects on adult snakes. A NOAEL and LOAEL will be derived from this experiment. We will measure hematological, immunological, and biochemical endpoints that may be candidates for biomarkers of selenium exposure and/or toxicity in wild snakes, and correlate these with selenium dietary exposure and with tissue residues of selenium in exposed snakes.

Second: Reproductive toxicity, embryotoxicity and teratology of selenium to garter snakes must be determined by exposing female common garter snakes before breeding and during gestation (Gillespie and Baumann 1986, Hansen and Deguchi 1996). We will evaluate reproductive success, and examine the offspring for selenium-induced defects. These findings will be related to exposure level and to tissue residue.

Third: Candidate biomarkers must be 'ground-truthed' by field testing in order to validate their usefulness for monitoring giant garter snakes. Common garter snakes and aquatic garter snakes will be caught and sampled both in areas of giant garter snakes abundance and in areas of decline. The biomarker endpoints measured in captured snakes will be compared to endpoint measurements from snakes that received laboratory exposure. Residue analysis of wild-caught common garter snakes will be compared to tissue residues in laboratory exposed snakes to evaluate whether wild garter snakes are at risk from selenium-induced health or reproductive effects. Selenium body burden of giant garter snakes' prey fish will be analyzed and compared to dietary concentrations found to cause health or reproductive damage in captive garter snakes. Finally, giant garter snakes both in areas of abundance and of decline will be non-lethally sampled and biomarker assays used to evaluate impacts of selenium on their health.

PROJECT DESCRIPTION

Project Approach

Following the recommendations of the Giant Garter Snake Recovery Plan and the CalFed ERP, we propose to conduct a study of the effects of dietary selenium on giant garter snakes. Our

approach will be to determine the effects of dietary selenium, via a controlled feeding study, on the health and reproductive success of captive common garter snakes as a surrogate test species, and to identify non-lethal biomarkers suitable for field monitoring of selenium exposure and effect on giant garter snake populations.

Task 1. Literature review

We will complete a review of pertinent literature bearing on the effects of selenium on garter snake reproduction and other suitable endpoints. Because responses of reptiles to environmental contaminants are poorly characterized, and because there is no published literature on toxic effects of selenium in snakes, the literature search will draw upon selenium toxicity and experimental data from other taxonomic groups, and will also incorporate aspects of *Thamnophis* (and Colubridae) biology that may influence toxic response. Emphasis will be placed on mechanistic information.

Task 2. Identification and characterization of non-selenium exposures

It is important to assess whether other contaminants, including agricultural chemicals, are present in giant garter snake habitat. The presence of potential confounding/interacting exposures in giant garter snake habitat will be identified from published literature, resource agency biologists and other knowledgeable sources. We also will identify and itemize other differences between parts of giant garter snake historic range in which it is still found, and from which it has disappeared.

Task 3: Collection of selenium-contaminated fish

Objectives/Methods To insure the relevance of this investigation to practical ecosystem management and giant garter snake recovery, experimental exposure of snakes to dietary selenium will include feeding common garter snakes fish that are caught in the wild from waterways with various levels of selenium contamination within the range and in appropriate habitat for giant garter snakes. For this purpose, the U. S. Fish and Wildlife Service (Service) will collect mosquitofish (*Gambusia affinis*), inland silversides (*Menidia beryllina*), red shiners (*Notropis lutrensis*), fathead minnows (*Pimephales promelas*), and carp (*Cyprinus carpio*). All of these non-native species are more or less abundant in waterways, including selenium-contaminated sloughs, in the Grasslands area of the San Joaquin Valley, which once supported a major population of giant garter snakes. Fish with three levels of selenium contamination will be caught (concentrations are mg/kg dry weight (wet weight)): low, 4 (1); medium, 4 – 12 (1 – 4), and high >12 (4). Fish with high concentrations of selenium will be caught in the lower portion of the San Luis Drain, which is currently being reused (as the "Grassland Bypass Project") to convey agricultural subsurface drainwater from Grasslands area farms to Mud Slough North. Fish with intermediate levels of selenium contamination will be collected from Mud Slough North below the outfall of the San Luis Drain where drainwater is diluted with low selenium water from upstream Mud Slough. Low selenium fish will be caught in Salt Slough where recent management measures have reduced the concentrations of selenium in the water and in fish to below levels that cause adverse ecosystem effects. Fish will be caught with 1/8 inch mesh bag and beach seines 30 ft to 50 ft long that will be dragged through waterways and backwaters.

Task 4. Measurement of selenium toxicity to adult common garter snakes.

Background/Significance

The toxicity of selenium and its distribution in California waters are succinctly reviewed in the ERP (CALFED 1998):

Water levels of selenium are useful guides for risk management only to the extent that they protect aquatic food chains from excessive bioaccumulation of selenium. As little as 0.1 µL of

selenomethionine, an organic form of selenium, can accumulate in zooplankton to an average level of 14.9 pg/g total selenium. This level of selenium in zooplankton, if fed to most species of fish, would cause dietary toxicity. Only 3.2 pg/g selenium in the diet was sufficient to adversely affect early life stages of chinook salmon under controlled conditions. Salmonids are very sensitive to selenium pollution. Survival of juvenile rainbow trout (*Oncorhynchus mykiss*) was reduced when whole-body levels of selenium exceeded 5 µg. Smoltification and sea water migration among juvenile chinook salmon (*Oncorhynchus tshawytscha*) were impaired when whole-body tissue levels reached about 20 kg/g. Mortality among larvae, a more sensitive life stage, occurred when levels exceeded 5 µg. Bluegill embryos resulting from ovaries containing 38.6 pg/g selenium exhibited 65% mortality.

Selenium presents a conundrum for risk assessment because it is a nutrient as well as a toxicant, and the thresholds for dietary necessity and dietary toxicity may be quite close, especially when considered across a taxonomic range. For this reason, successful management of selenium, even more than other environmental contaminants, requires an understanding of its mechanism and species-specific and site-specific behavior.

Toxicity data for reptiles is extremely limited. The risk of contaminants to reptiles is so poorly known that current guidelines are based on a presumption of response similar to fish and birds. Tissue concentrations of selenium that are regarded as toxic thresholds for overall health and reproductive success in fish are (wet weight): whole body 1 µg/g; skeletal muscle, 2 µg/g; ovary and eggs, 2.5 µg/g (Lemly 1996a). In birds, sublethal effects are seen at liver selenium concentrations of 2.5 ppm, and significant reproductive effects (embryonic deformity) at liver concentrations in adults of 2.25 ppm (Heinz 1996).

Test species: Common garter snake, because of its wide distribution and abundance, is better characterized than other garter snakes species, therefore information is available on its natural history and reproductive biology (Charland 1995, Crews et al. 1993, Gregory and Larsen 1993, King and Turmo 1997, Larsen et al. 1993, Lyman-Henley and Burghardt 1995, Mason 1993, Peterson et al. 1996, Peterson et al. 1998, Rossman et al. 1996). Data on giant garter snakes natural history and reproductive biology is summarized in the Recovery Plan (USFWS 1998) and reported in several earlier sources (Hansen 1990, Rossman et al. 1996).

Objectives/Methods Snakes for exposure trials will be purchased from commercial sources. Snakes from commercial sources have the advantage of lower cost, less genetic variation and reduced impact on free-living populations. Captive-bred snakes are also more likely to breed in captivity. Reputable commercial suppliers of garter snakes include Wm. A. Lemberger Co. Inc, Oshkosh, WI; Larry Lantz, South Bend, IN; Charles D. Sullivan, Nashville, TN; Reptilia Technologies, Los Angeles, CA. Snakes will be held in terraria provided with escape-proof, ventilated lids, aspen chip bedding, tip-resistant water/food containers, and hiding places. Ambient room temperature plus heat pads will provide each cage with a temperature gradient of 22° to 30°C (Ford 1996b, Mattison 1992). Body weight and length, and gender will be determined before snakes are assigned to treatment groups. Snakes will be assigned randomly to treatment groups and acclimated before exposure. Dietary exposure of adults: Exposure modes include fish caught from site, and fish spiked with known amounts of selenium, as seleno-L-methionine. Wild caught fish will be divided into species and size classes and a sample of each group analyzed for total selenium content in order to assign them to low-, medium-, high-selenium exposure groups. Exposure groups for both trials is summarized in Table 1. Group sizes were determined by power analysis (Steidl et al. 1997).

Three additional groups of snakes will receive mosquitofish raised in the mosquitofish research colony at UCD, and spiked with known amounts of selenium, as seleno-L-methionine (Bird et al. 1997, Hoffman et al. 1996b, Wang and Lovell 1997). Alternatively, feed fish may be 'spiked' by feeding them a diet of *Artemia* raised on selenized yeast, a method which is currently under development at TIEH/UCD.

Task 5: Biomarker development and application

Background/significance Although the mechanism of selenium toxicity has not been definitively identified, generation of reactive oxygen species is among the hypotheses proposed (Seko and Imura 1997). If proven, this would be a paradoxical mechanism as the protective role of selenium against methylmercury-induced oxidative damage via selenium-dependent glutathione peroxidase is well supported (Chang et al. 1982, Di Simplicio et al. 1993, Hoffman and Heinz 1998, Rana and Boora 1992). Interestingly, the glutathione system enzymes also protect garter snakes from oxidative damage resulting from anoxia or freezing/thawing (Hermes-Lima and Storey 1993).

Hoffman and Heinz (1998) reported an increase in hepatic glutathione (GSH) peroxidase, oxidized glutathione (GSSG), GSSG reductase, and thiobarbituric acid-reactive substances (TBARS) in mallards exposed to 10 ppm Se as selenomethionine. At 10 ppm there was no significant increase in plasma GSH peroxidase in adult mallards. However in an earlier study in which mallard ducklings were exposed to 15 or 30 ppm dietary selenium in various forms for two weeks, all forms caused significant increase in both plasma and hepatic GSH peroxidase activities. Selenomethionine was the most toxic form, causing the greatest increase in the ratio of oxidized to reduced hepatic glutathione (Hoffman et al. 1996a). Numerous other studies have reported that selenomethionine is the most bioavailable and toxic form of selenium (Daniels 1996, Goede and Wolterbeek 1993, Hasegawa et al. 1996, Heinz et al. 1996, Panter et al. 1996). Immune system effects of selenium have been reported by several investigators (Fairbrother and Fowles 1990, Hogan 1998).

Objective/Methods Biomarkers investigated in captive garter snakes will include both non-lethal methods (from blood or muscle punch) and methods requiring post-mortem harvesting of tissues. *The long term goal is to identify a panel or profile of biomarkers that is characteristic of selenium toxicity from among the endpoints accessible via non-lethal sampling.* At the end of the exposure trial, blood samples will be taken from the caudal vein and snakes will be euthanized via ketamine injection followed by decapitation. Body weights will be recorded and brains, livers, kidneys and spleen removed and weighed. A section of liver, one kidney and the spleen will be fixed for histopathological analysis. Blood plasma and remaining liver will be immediately frozen at -80 for subsequent residue and biochemical analysis.

We will optimize for snake tissue the assay methods for the candidate biochemical biomarkers of selenium toxicity: total glutathione and GSSG by the methods of (Vandeputte et al. 1994) based on the method of (Teitze 1969) modified for the 96-well platereader; activities of glutathione peroxidase, reductase and s-transferase will be measured by the methods of (Jaskot et al. 1983) as modified by (Mosca et al. 1996). We will measure TBARS, G-6-PD, GSSG:GSH ratio, and malondialdehyde as measurement of lipid peroxidation (Hoffman et al. 1989). Other candidates may be added as a result of literature survey and of preliminary work now in progress at UCD.

Standard blood chemistry panels will be conducted by Consolidated Veterinary Diagnostics, Sacramento CA, and include indicators of general health and contaminant exposure: hemoglobin, hematocrit, alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine kinase. (Hoffman et al. 1991).

Snakes in the captive colony will be tested for immunocompetence at two times during the exposure period, weeks 6 and 10. We will utilize three assays that will examine antibody-mediated, cell-mediated, and innate immunity. Different immunogens are used at the two time points so that we are testing naïve responses each time.

To examine the antibody response, snakes will be injected intra-abdominally with 1 ml of a 50% w/vol solution of sheep red blood cells (week 6) or rat red blood cells (week 12). Five and eight days later, 1 ml of blood will be taken and serum antibody levels will be quantified by a hemagglutination assay (Wegmann and Smithies 1968). To examine cell mediated immunity 0.1 ml of phytohemagglutinin (1 mg/ml; week 6) or *Staphylococcus aureus* (10^9 cells/ml; week 10)

will be injected into the skin and the amount of swelling will be evaluated 24 hrs. This test is a measure of delayed type-hypersensitivity mediated by T-lymphocytes (Warner et al. 1971). To examine innate immunity, 1 ml of 100 µg/ml *Escherichia coli* lipopolysaccharide (week 6) or *Salmonella typhimurium* lipopolysaccharide (week 12) will be injected intra-abdominally. Six and 12 hrs later, the induction of fever will be monitored by determining rectal body temperature using a thermistor probe. The assays will be conducted in the following order so that only 1 test is operative at any time: Day 1, innate immunity; day 3, delayed-type hypersensitivity; day 6, antibody response.

We will then correlate hepatic and plasma biochemistries, and immunocompetence results with lesions determined by histopathologic analysis, with selenium tissue residue and with selenium dietary exposure level.

Measurement of blood chemistry and enzyme activities, and histopathological assessment of selenium-induced lesions addresses the selenium Data Gap listed on page 8-6 of ERP Volume 1:

"Other chronic impacts on fish and wildlife, such as immunosuppression and sensory damage"

Task 6: Selenium residue analysis

Background/justification In order to relate selenium body burden to indices of selenium toxicity, we will measure total selenium in experimental snakes, wild-caught snakes, and their food. Because of the greater bioavailability and toxicity of selenomethionine compared to other forms of selenium, it is important to determine the proportion of total Se present as selenomethionine in the wild-caught fish used to expose the experimental garter snakes. (For snakes exposed via spiked fish, we will use mosquitofish fed *Artemia* raised on a diet of selenized yeast, thus providing a known proportion of Se as selenomethionine or alternatively mosquitofish spiked directly with selenomethionine)(Bird et al. 1997, Hoffman et al. 1996b, Wang and Lovell 1997).

Objective/Methods Total selenium residue analysis will be determined by microdigestion followed by fluorescence detection (Fan et al. 1998). Selenomethionine will be determined by GC-MS (Fan et al. 1997).

Determining the proportion of total selenium present as selenomethionine addresses the Data Gap listed on page 8-6 of ERP Volume 1:

"Evaluation of various seleno-amino-acids in biota to establish the toxic and ecotoxic mechanism of selenium, critical to the establishment of site-specific water quality criteria."

Task 7: Histopathological analysis of exposed snakes

Background/justification Histopathological lesions associated with selenium exposure have been documented for fish, birds and mammals. (Hamilton et al. 1986, Sayato et al. 1993, Srivastava 1995, Hoffman et al. 1991)

Objectives/Methods Routine histopathology will be used to assess contaminant-related adverse effects in organs and tissues. Tissues for routine histopathology will include: liver, kidney, spleen, stomach, intestine, gonad, and brain. Samples for routine histopathology (and immunohistochemistry) will be fixed in 10% neutral buffered formalin and processed (dehydration, infiltration, and embedding) in either paraffin or glycolmethacrylate (GMA). Paraffin or GMA blocks will be sectioned at 4-6 µm, mounted on glass slides, and stained with hematoxylin and eosin. All lesions will be semi-quantitatively scored (0 = not present, 1 = mild, 2 = moderate, 3 = severe) on the basis of size and number. Attempts will also be made to localize metallothionein and stress protein induction in exposed snakes using similar techniques in some samples. Immunohistochemical techniques will be applied on a limited basis to some samples.

Task 8: Optimization of captive breeding conditions

Preliminary reproductive trial: It will be necessary to ensure that optimum breeding conditions are obtained in our animal facility before the definitive reproductive trial. A small group of snakes will be assigned to a preliminary breeding colony in Year 1 to optimize breeding conditions in our laboratory in preparation for full reproductive trial in Year 2.

Task 9: Characterization of common garter snake selenium body burden and effects in giant garter snake range

Background/Significance Concentrations of total selenium in giant garter snakes habitat and sympatric species (all concentrations have been converted to *wet weight*): Liver selenium concentrations of 2.67 µg/g have been reported for gopher snakes (*Pituophis melanoleucus*) at Kesterson, compared with 0.365 µg/g at Volta (Ohlendorf et al. 1988a). Specifically, selenium concentrations above toxicity thresholds have been found in giant garter snake prey: Whole body selenium concentrations in mosquitofish (*Gambusia affinis*) were 29.7 – 98 µg/g at Kesterson, compared with 0.32 µg/g at Volta (Saiki and Lowe 1987). In other sites within giant garter snake range (the San Joaquin River and in various tributaries south of Los Banos) reported selenium concentrations in bluegill range from 0.11 to 1.32 µg/g; and in carp (*Cyprinus carpio*) 0.14 to 1.07 µg/g (Saiki and Lowe 1987). More current residue measurements from September 1997 were 1.93, 3.9 and 2.0 mg/kg in mosquitofish, inland silversides and fathead minnow respectively, from Mud Slough below the Grasslands discharge site (Beckon et al. 1998).

Objectives/Methods To collect common garter snakes, Service biologists will lay 4' x 4' pieces of flake-board at intervals of about 100 ft along Mud Slough (North) in the Kesterson Unit of the San Luis National Wildlife Refuge Complex. Placement of hiding boards has been very effective in attracting garter snakes in an ongoing study at E.E. Wilson State Wildlife Refuge in Oregon (Wolfe, unpublished data). Two to four weeks later we will lift each board to check for and capture garter snakes resting under the boards. At the end of the collection effort, all boards will be retrieved from the Refuge.

We will measure selenium body burden (concentration and form) in common garter snakes and aquatic garter snakes (*Thamnophis couchi*) collected from giant garter snake range and habitat.

Task 10: Determination of selenium reproductive toxicity to common garter snakes

Background/Significance Teratogenic and embryotoxic effects of effects of selenium are known from studies with birds and fish. Selenomethionine is a stronger teratogen and embryotoxicant than selenate or selenite. In fish, deformities included misshapen heads and mouths, lateral curvature of the spine (scoliosis), humpback (kyphosis), concave curvature of the lower spine (lordosis), edematous effects such as 'popeye' and distended pericardial and abdominal cavities, and malformed caudal peduncles. Deformities reported in birds included missing or abnormal beaks, eyes, feet wings and legs, with anomalies of internal organs (brain, liver, heart) also observed. (Heinz et al. 1989, Hoffman et al. 1988a, Hoffman et al. 1985, Lemly 1993, Lemly 1997, Ohlendorf et al. 1986, Ohlendorf et al. 1989).

Mammals are apparently not at similar risk (O'Toole et al. 1996). In an effort to determine the reason for the lack of selenium-induced limb defects in mammalian fetuses, Rousseaux and coworkers exposed mouse limbs in culture to sodium selenite or selenomethionine. Sodium selenite, but not selenomethionine, induced a concentration-dependent maldevelopment of anlagen of exposed fetal limbs, leading these authors to conclude that both pharmacodynamics and differences in tissue sensitivity accounted for the difference between avian and mammalian susceptibility to selenium-induced teratogenesis (Rousseaux et al. 1993). Whether the live-bearing garter snakes would follow the avian, piscine or mammalian response pattern is unknown, and must be determined experimentally.

Objective/Methods Snakes will be artificially hibernated at 10 °C to bring them into breeding condition before being paired for courtship and mating. After mating has been verified females will be fed fish containing different concentrations of selenium for as long as they continue to feed (female garter snakes typically stop feeding for the last several weeks before parturition). (Ford 1996a). Reproductive outcome and number and condition of offspring will be recorded (Heinz and Hoffman 1998, Naddy et al. 1995, Nakamoto and Hassler 1992).

Table 1. Exposure of common garter snakes to dietary selenium.

GROUP	TREATMENT	TIME	NUMBER
Year 1			
Adult	Subchronic	12 weeks	
Group 1	control		8
Group 2	low		8
Group 3	medium		8
Group 4	high		8
			32
	fed spiked fish		
Group 5	low		4
Group 6	medium		4
Group 7	high		4
			12
Year 2			
	Reproductive		
Group 8	control	12 each, male & female	24
Group 9	low	12 each, male & female	24
Group 10	high	12 each, male & female	24
			72

Task 11: Histopathological analysis of snakes young or snakes embryos

Objectives/Methods Routine histopathology will be used to assess teratogenic effects in organs and tissues of the offspring of exposed snakes. Tissues for teratogenesis/embryotoxicity histopathology will be handled as described under Task 7.

Task 12: Field application of biomarkers and sampling of wild snakes

We will collect common garter snakes from within giant garter snake range. Some snakes will be collected and tissues harvested for residue analysis, enzyme activity and histopathology. Other snakes will be blood-sampled only, or blood sampled and tested for immunocompetence then released.

We will coordinate our snake monitoring and collection efforts with the ongoing giant garter snake survey program in the Grasslands area being conducted jointly by California Department of Fish and Game, the Grassland Water District, and the San Luis National Wildlife Refuge Complex. Our snake-collection efforts will be directed at obtaining common garter snakes to serve as surrogates for listed giant garter snakes. However, we may incidentally attract giant garter snakes to the shelter boards that we put out for common garter snakes. Should we catch any giant garter snakes, we will conduct non-lethal (blood) sampling and then immediately release them at the capture location or immediately turn them over to California Fish and Game biologists for inclusion in their survey program. We have contacted the Endangered Species Division (Frank Muth, San Joaquin Valley Branch) of the U.S. Fish and Wildlife Service to initiate the process of obtaining an Endangered Species Act Section 10.a.1.A. permit for the "scientific take" of giant garter snakes.

Task 13: Residue analysis

Tissue concentrations of total selenium and selenomethionine will be conducted as in Year 1.

Task 14: Biochemical assay

Biochemical and hematological assays will be conducted as in Year 1. Tissue selenium residue and blood biochemistry endpoints of wild-caught snakes will be compared with those of laboratory-exposed snakes.

Task 15: Data Reduction, Validation and Reporting

Data Recording Laboratory data will be recorded according to EPA Laboratory Notebook Policy. Field data will be recorded on waterproof paper forms and kept in three-ring binders. Computer print-outs, custody forms and sample tracking forms will be kept in three-ring binders. Data will be entered into Excel spreadsheets from which summary statistics will be calculated. Copies of computer files will be kept on separate hard drives or other storage media. Files will be backed up daily during data entry and weekly thereafter. Accuracy of data entry will be assessed by rechecking a randomly selected portion of the data, and by evaluation of summary statistics for range and reasonableness.

Data Archive All data sheets, log book pages, and custody forms will be copied and turned in for archiving at the end of the study. Originals will be retained by the PIs.

Statistical analysis Data will be entered into Excel spreadsheets (Microsoft Corp. Redmond WA) from which summary statistics (means, standard deviations or standard error and coefficients of determination or variation will be calculated). Excel's statistical package will be used to test differences between means via Students *t*-test or other appropriate analysis. SYSTAT (SYSTAT Corp. Evanston IL) will be used for regression, ANOVA and other appropriate procedures. Sample sizes will be determined by power analysis.

YR 1	TASK	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	Literature review	x	x										
2	Identification and characterization of non-selenium exposures	x	x	x	x								
3	Collection of selenium-contaminated fish	x	x	x	x	x							
4	Measurement of selenium toxicity to adult CGS			x	x	x	x						
5	Biomarker development and application			x	x	x	x	x	x	x			
6	Selenium residue analysis			x	x	x	x	x	x	x			
7	Histopathological analysis of exposed snakes												
8	Optimization of captive breeding conditions					x	x	x					
YR 2													
9	Characterization of CGS selenium body burden and effects in CGS range									x	x	x	x
10	Determination of selenium reproductive toxicity to CGS								x	x	x	x	
11	Histological analysis of snake young or snake embryos											x	x
12	Field application of biomarkers and sampling of wild snakes										x	x	x
13	Residue analysis		x	x	x	x	x	x	x				
14	Biochemical assay		x	x	x	x	x	x	x				

YR 3						
9	Characterization of CGS selenium body burden and effects in GGS range	x	x	x	x	
12	Field application of biomarkers and sampling of wild snakes	x	x			
13	Residue analysis		x	x	x	x
14	Biochemical assay		x	x	x	x
On-going tasks						
15	Data reduction, validation and reporting					All months, all years.
16	Project Management					

Task 16: Project management

Field portions of the proposed project will be managed by Steve Schwarzbach and Bill Beckon, USFWS. Marti Wolfe, UC Davis will direct laboratory exposure and analytical phases. Field testing and monitoring phases will be managed jointly.

LOCATION AND/OR GEOGRAPHIC BOUNDARIES OF THE PROJECT

This project will focus on the Grasslands area of the San Joaquin Valley in the vicinity of the city of Los Banos in Merced County because the wetlands and sloughs in this area historically supported a major population of giant garter snake, but as selenium in agricultural drainwater became a major problem in the area giant garter snakes evidently disappeared. Tissue and/or blood samples taken by the Biological Resources Division of the U. S. Geological Survey from other areas of the Central Valley may also be analyzed for comparison.

Ecological Management Zones incorporated in this project are Sacramento-San Joaquin Delta, East San Joaquin Eastside Delta Tributaries, (pp 53 and 187 of ERP)

ECOLOGICAL AND BIOLOGICAL BENEFITS

Ecological/Biological Objectives

The object of this project is to provide information that will help ascertain if selenium toxicity is an impediment to the recovery of the giant garter snake. This information may be vital to a successful recovery plan for giant garter snakes in the San Joaquin Valley. If this investigation shows that dietary selenium is toxic to giant garter snakes at concentrations currently found in the San Joaquin Valley, then measures will need to be implemented to reduce selenium contamination of giant garter snake habitat in the San Joaquin watershed, or effective restoration efforts will need to be confined to those portions of the watershed that exhibit selenium concentrations below the threshold of toxicity to giant garter snake.

Alternative approaches

An alternative approach to determining dietary toxicity of selenium to giant garter snake would be to directly test giant garter snakes by capturing them and feeding them selenium-contaminated fish. However, such a program would be ill-advised in view of the extremely small numbers of these snakes remaining in the San Joaquin Valley. Another alternative approach would be to rely on studies done on other species to provide guidance on the toxicity of selenium to giant garter snakes. Unfortunately, to the best of our knowledge, no studies whatever have been done on the effects of dietary selenium on any snake species. Extrapolations would have to be made from studies on fish, birds and mammals. These

extrapolations would be tenuous, because those taxa are only very distantly related and they occupy quite different ecological niches.

Adaptive management

The essence of adaptive management is responsiveness of management to new information. Therefore a vital element of adaptive management is expanding and updating knowledge of threats to species as well as knowledge of the evolving status of species and ecosystems. This investigation will provide needed information on an important threat to populations of giant garter snakes, splittails and other aquatic species. This information will form the basis of adaptive management of these species and their ecosystems.

Durability of project benefits

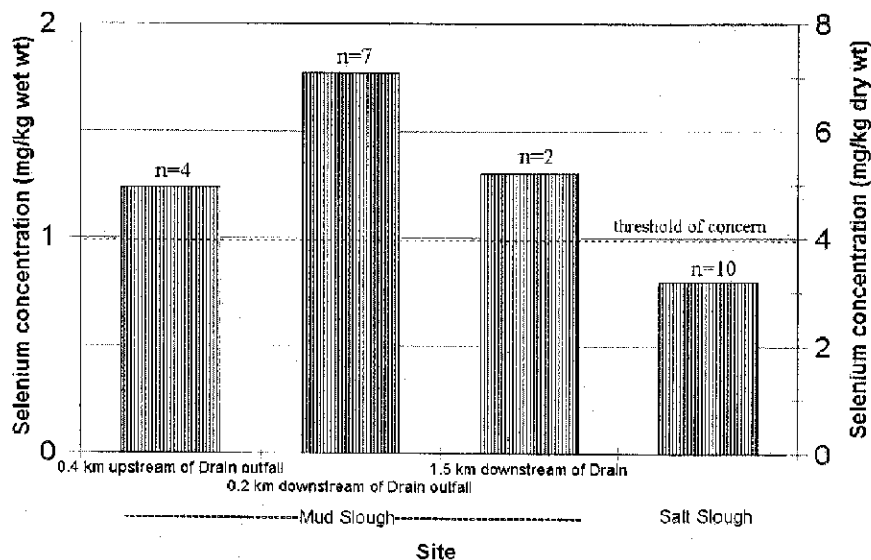
Oil refining, coal-fired power plants, and irrigated agriculture in the arid environments are the principal known causes of elevated concentrations of selenium in aquatic ecosystems (Skorupa 1998). Therefore, as long as fossil fuels are extracted and burned, and as long as low-cost water supports irrigation of arid western lands, the knowledge of selenium toxicity that will be produced by this investigation will continue to be widely applicable to ecosystem protection.

Linkages

Splittail

The splittail, a species of fish federally listed as threatened, is at risk from selenium in the same sloughs in the Grassland area where giant garter snakes may be adversely affected by selenium.

In June 1998, splittails were collected in Mud and Salt Sloughs by the U. S. Fish and Wildlife Service as part of the monitoring program for the Grassland Bypass Project (USBR et al 1996). These fish were analyzed for contaminants and found to have selenium concentrations at levels of concern at all Mud Slough monitoring sites. Selenium concentrations were highest (composite = 7.1 mg/kg, n=7) just below the outfall of the San Luis Drain (Figure x). Any measures taken as a consequence of this investigation to alleviate the selenium problem for giant garter snake will also benefit splittails.



Specify the ERP strategic objective and target(s) that the project addresses.

The primary ERP Strategic Objective supported by this project is stated in Volume I on page 320: The Strategic Objective is to restore populations of giant garter snakes to its historical range.

An additional ERP Strategic Objective supported by this project is stated in Volume I on page 209: The Strategic Objective is to restore the Sacramento splittail to the Delta, Suisun Bay, and the Central Valley.

In addition, this project supports a Water Quality Priority Action stated in Volume I on page 8-17: Reduce selenium concentrations in biota to levels below ecological risk guidelines.

Focused Action supported: Water Quality - Sacramento River, San Joaquin River and the Delta. *Perform toxicity testing, identify toxic agents in toxic samples and develop toxicity testing methods using Delta species.* RFP page 24

Project will help CALFED with its overall objectives by improving monitoring of two Priority species and providing information essential to water quality management decisions.

Explain how the project relates to any existing legal obligations of agency mandates :

Since 1992, the U. S. Fish and Wildlife Service has been monitoring selenium levels in water, fish, and aquatic invertebrates in the sloughs in Grasslands area wildlife refuges to measure the effects of agricultural subsurface drainwater discharged through the area. In 1996 this Service monitoring effort was incorporated into a larger interagency monitoring program (USBR et al 1997). The giant garter snake is a top predator in such sloughs and wetlands as those in this area. Therefore it would be reasonable to suspect that this species might be adversely affected by selenium moving up the food chain. Nevertheless, the giant garter snake was not included in the monitoring program. This was in part because, although a major population of giant garter snake had historically inhabited these sloughs, the species had not been found in this area since the 1970's and was presumed to be locally extirpated. Then in 1997 a giant garter snake was found near the town of Gustine, and in a 1998 trapping program funded by CALFED, eleven giant garter snakes were found in the Grasslands area (Chad Sien, pers. com.). However, just as the need and opportunity to monitor selenium in garter snakes was becoming evident, funding for the Service biological monitoring program expired. Service funding for continuation of biological monitoring in fiscal year 1999 has been rejected. Unless the Service can secure support for the existing program from another source, even the core fish and invertebrate monitoring program must be suspended. The addition of snakes to the monitoring effort is not possible without the support of CALFED.

System-wide Ecosystem Benefits

Elevated selenium concentrations are a threat to ecosystems throughout much of the eastern side of the San Joaquin-Sacramento watersheds, from the Tulare Basin to the Bay Area and at least as far north as Yolo County. Additionally, because industry and agricultural practices have generated problems of selenium contamination in aquatic snake habitats at widely distributed locations across the North American continent (Skorupa 1998), knowledge acquired in this program will have immediate broad application to wildlife conservation efforts and management planning well beyond these California watersheds.

Compatibility with Non-Ecosystem Objectives

Benefits for other CALFED objectives include coordination with ongoing giant garter snake surveys being conducted under the San Joaquin River National Wildlife Refuge Riparian Habitat Protection and Floodplain Restoration Project

There are no conflicts with other CALFED objectives.

TECHNICAL FEASIBILITY AND TIMING

An alternative to performing this work would be to make management decisions for restoration of the giant garter snakes based only on existing information. However, this would put resource managers and risk managers in the biologically untenable position of making important decisions while handicapped with significant data gaps about an important factor potentially bearing on giant garter snakes recover, i.e. the potential impact of selenium.

MONITORING and DATA COLLECTION METHODOLOGY

Biological/Ecological Objectives

The objects of this project are:

- 1) to provide information that will help ascertain if selenium toxicity is a factor in the decline of giant garter snakes populations.
- 2) increase the understanding of selenium bioavailability and toxic mechanism
- 3) contribute an understanding of the impacts of selenium on splittail.

The knowledge gained from this work will inform management decisions aimed at restoration of the giant garter snakes and the splittail, and at regulating selenium.

Activities to be performed and hypotheses to be tested

Hypotheses to be tested are

- 1) Dietary selenium is causing health and reproductive effects sufficient to limit the recovery of giant garter snakes in selenium-bearing parts of its range.
- 2) Common garter snake is a good surrogate test species for the response of giant garter snakes to selenium toxicity.
- 3) Exposure and toxicity of selenium in giant garter snakes can be monitored by non-lethal biomarkers.

Monitoring Parameters and Data Collection Approach

Standard quality control procedures (ASTM) will be employed.

Sample selection, collection and preparations Selenium residue analysis will be conducted on tissues harvested from exposed and control animals. Functional analyses (histological, biochemical, hematological) selected as appropriate endpoints and toxicity determiners will be performed. Samples will be collected at intervals during the exposure period and after sacrifice at the end of the experiment.

Sample handling, identification, preservation and transportation Sample handling: Samples will be stored in double zip-lock bags, with label between the bags. Samples requiring refrigeration or freezing will be kept frozen until shipped to the analysis laboratory. Each sample will be entered on the Sample Tracking Log with date and place collected, sample ID and initials of person collecting.

Sample labeling Samples labels will contain the following information: Sample identification number, collection location, species, age and initials of person collecting/preparing samples. The Sample Tracking Log will be the responsibility of the Project Scientists.

Sample Custody: Shipped samples Samples will be prepared for shipping by placing a custody seal over each box of samples, packing the boxes in ice chests with dry ice or coolant as appropriate, and securing the boxes with strapping tape. Sample tracking logs and Chain of Custody forms will be put in plastic bags and taped to the inside lid of the shipping container.

Forms Chain of Custody forms will contain the following information: Sample identification numbers, person preparing the shipment, date and time of shipment, shipper or transporter, person delivering and person, and time date received receiving the sample.

Sample tracking Each sample will be entered on the Sample Tracking Log with date and place collected, sample ID, and initials of person collecting.

Laboratory

Sample receiving and log-in The person responsible for receiving the samples at the UC Davis Toxic Pollutants Health Research Laboratory will reconcile the shipped samples with the Sample Tracking Log, enter the location or freezer the samples are transferred to, and date and initial the Log.

Analytical Procedures Morphological measurements of test snakes will include body weight, organ weight and sex. Procedures for taking morphological measurements and preparing samples are described in SOP: Necropsy and Tissue Sample Collection and Preservation (on file with the PI)

Selenium analysis Samples for total selenium and selenomethionine will be reported on a ppm wet weight, or ppm dry weight, % moisture basis. Lyophilized selenium tissue samples remain stable indefinitely, though we will typically process samples within 6 months of collection. Digestates in sealed tubes have also been demonstrated to be stable for several years, however, we will typically process these within 6 weeks. QA/QC samples comprise 10% of the tubes in each run including a set of at least 8 selenium standards, a minimum of 3 certified reference material samples in an appropriate matrix, and duplicate and spike recovery samples each at a ratio of approximately 10%. QA/QC samples pass through all phases of the digest and are treated identically to analytical samples. Replication is typically \pm 5% difference between duplicates, recoveries of certified reference materials are almost always within 20% of certified values, spike recoveries within 20% of predicted concentrations, and standard curves generally demonstrate R^2 values in excess of 0.98.

Calibration Frequency and Procedures Scales used for body weights of animals in the clinic and field will be calibrated with the analytical balance in the laboratory. pH meters are calibrated daily, and the calibration log is initialed. Analytical balances are calibrated quarterly. Spectrophotometers are calibrated with standard reference material of known wavelengths. Calibration procedures for the selenium analysis methods include QA/QC procedures listed above.

Data Evaluation Approach

Precision, accuracy, representativeness, completeness, and comparability: All animals sampled or collected will have all pertinent tissues and measurements taken, and all measurements will be accurately logged. Numbers of animals in each experimental group was determined by either: the number of samples necessary to obtain a significant difference at $p=0.05$, or in, the case of sample sizes too small to yield statistically significant measures, the standard of completeness shall be biological significance. Functional tests selected, tissues sampled and toxicity endpoints assessed represent measurable impacts of selenium on wildlife animals. Species selected, measurements taken and tissues sampled are comparable to published parameters of selenium impact on animals.

Internal Quality Control Checks Members of the research team will be trained by the Project Leaders in the performance of data collection and biological sampling tasks. Between-observer variation in data which has a subjective component will be determined and corrected periodically during the study. Data notebooks will be reviewed periodically by the PIs.

Performance and System Audits Audits of the study, performance checks of team members and review of data will be conducted by the Principal Investigators. Inter-observer observations will be controlled by blind re-inspection of 10% of another observers results, for those measures which have a subjective component (i.e. body fat index), and corrected by review of measurement criteria.

Hypothesis/Question to be Evaluated	Monitoring Parameter(s) and Data Collection Approach	Data Evaluation Approach	Comments/ Data Priority
Concentrations of selenium in fish in GGS range are sufficient to cause toxicity to common garter snakes	Expose adult CGS, measure hematological, histological, immunological and biochemical endpoints, and tissue residue in exposed snakes.	Derive NOAEL and LOAEL, compare endpoint measurements from treatment groups with endpoint measurements from controls. Test for significance	All tasks have equal priority, as all are inter-dependent and essential to the objectives of the project.
Concentrations of selenium in fish in GGS range are sufficient to cause reproductive impairment to common garter snakes	Expose adult CGS before breeding and female CGS during pregnancy	Compare reproductive success and offspring health between control and treatment groups. Compare to tissue residue and toxic endpoints in parent snakes. Test for significance	
Toxic response of laboratory-exposed CGS are representative of toxic response of wild CGS	Apply biomarkers and sample CGS in GGS range. Non-lethally sample GGS in selenium-bearing and selenium-free areas of its range.	Compare . Compare tissue residue, biomarker evidence toxic endpoints in all snake groups. Test for significance	

LOCAL INVOLVEMENT

Notification of Local Government and Public Involvement. The agencies/entities listed below have been notified.

Merced County Board of Supervisors
2222 M. St.
Merced CA 95340
(209) 385-7366

Merced County Planning and Development
2222 M. St.
Merced CA 95340
(209) 385-7366

California Department of Fish and Game
Los Banos Wildlife Refuge
18110 W. Henry Miller Ave.

Los Banos CA 93635
John Bean/ Chad Sien
(209) 826-0463

Project: Assessment of Distribution and Status of Giant Garter Snake on State Land

Glenn Wiley
Western Ecological Research Center
Dixon CA
(707) 678- 0682 x 616

Tina Chouinard
U. S. Fish and Wildlife Service
San Luis National Wildlife Refuge Complex
947 West Pacheco, Suite C
Los Banos, CA 93635
(209) 826-3508

Tina_Chouinard@mail.fws.gov

CALFED supported project: San Joaquin River National Wildlife Refuge Riparian Habitat
Protection and Floodplain Restoration Project

Notification of the general public will be accomplished by submitting news release-type descriptions of the project and its progress to websites of the resource agencies involved, and websites and/or newsletters of local conservation organizations.

For an example, see a non-technical description of the PI's recent project at:

<http://www.tsrtf.ucdavis.edu/tsrtf/newsletters/homepage.html> Winter/Spring '98

COST

See Appendix.

Budget

See Tables 3, Table 4 and following in Appendix.

Schedule

Schedule is given on page 9.

Cost-sharing

The project will be supported entirely by CalFed funds.

Applicant Qualifications

See attached resumes

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APPENDIX

MARTI F. WOLFE, PH.D., UNIVERSITY OF CALIFORNIA, DAVIS

Figure 1 – Map of Selenium and Giant Garter Snake Distribution

Budget Tables 3 and 4 and following annual breakdown.

Resumes

Letters of Notification

Attachements D & E (State and Federal Forms)

Figure 1
SELENIUM CONCENTRATIONS IN SHALLOW GROUND WATER
 Sampled between 1984 and 1989

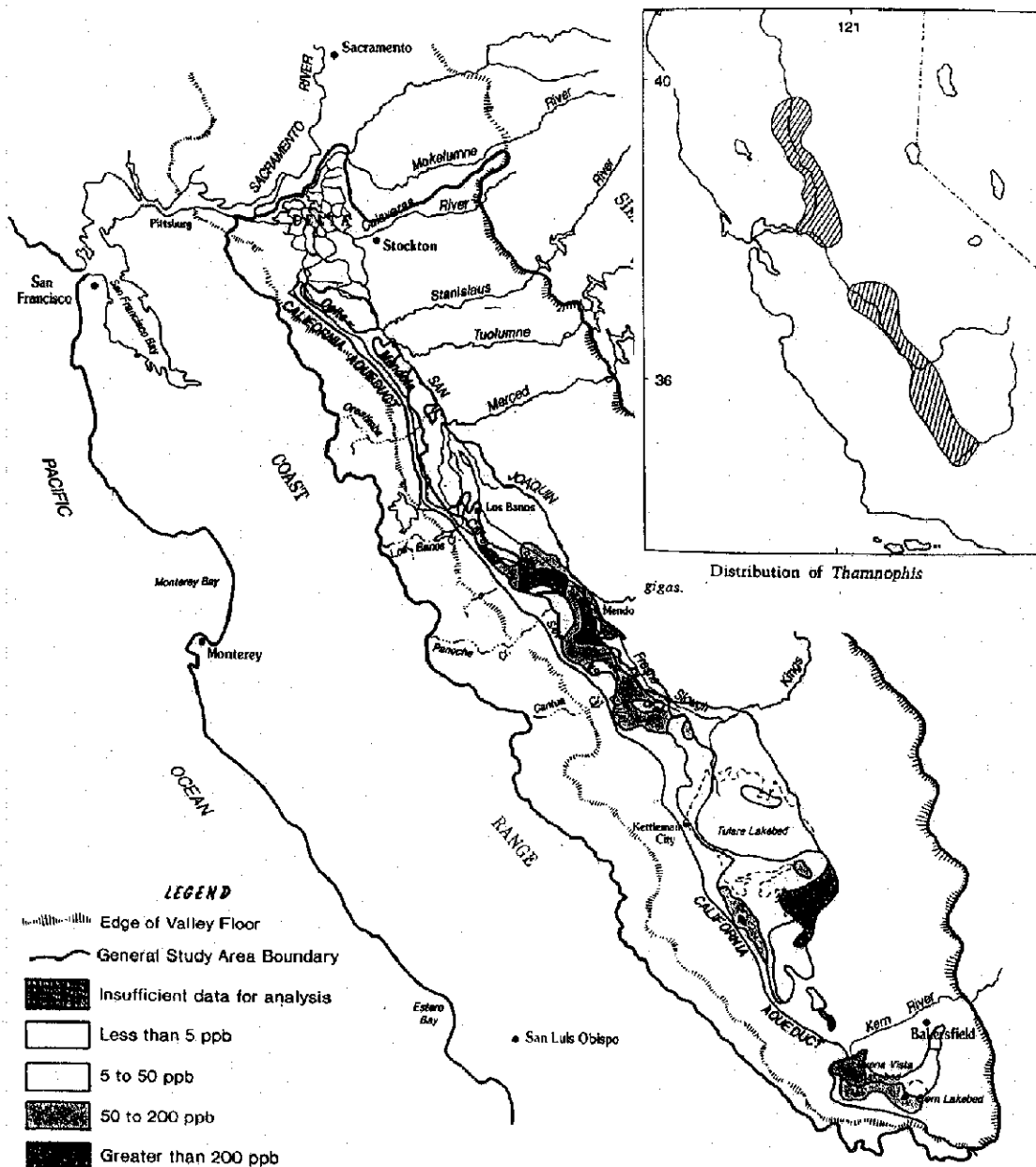


Table 3. Task Based Budget October 1, 1999 - March 31, 2002

Task #	Task	Direct labor hours	Direct Salary and Benefits	Service Contracts	Material and acquisition costs	Miscellaneous and other direct costs	Overhead and Indirect costs (10%MTDC)	Total costs
1	Literature review	2.5%	\$4,377.00			\$650.00	\$381.00	\$5,408.00
2	Identification and characterization of non-selenium exposures	5.0%	\$7,535.00				\$632.00	\$8,167.00
3	Collection of selenium contaminated fish	Subcontractor USFWS		\$136,442.00			\$2,500.00	\$138,942.00
4	Measurement of selenium toxicity to adult CGS	12.5%	\$17,011.00		\$5,030.00	\$2,000.00	\$2,282.00	\$26,323.00
5 & 14	Biomarker development and application	18.0%	\$23,960.00		\$31,750.00	\$3,500.00	\$3,224.00	\$62,434.00
6&13	Selenium residue analysis	7.5%	\$10,694.00		\$6,300.00	\$400.00	\$1,618.00	\$19,012.00
7	Histopathological analysis of adult snakes	Subcontractor Swee Teh		\$4,200.00			\$420.00	\$4,620.00
8	Optimization of captive breeding conditions	8.5%	\$11,957.00				\$1,074.00	\$13,031.00
9	Characterization of CGS selenium body burden and effects in GGS range	8.5%	\$11,957.00			\$1,000.00	\$1,174.00	\$14,131.00
10	Determination of selenium reproductive toxicity to CGS	12.5%	\$17,011.00	\$139,717.00	\$5,310.00		\$2,110.00	\$164,148.00
11	Histopathological analysis of offspring of exposed snakes	Subcontractor Swee Teh		\$5,500.00			\$550.00	\$6,050.00
12	Apply biomarkers and sample CGS in GGS range. Non-lethally sample GGS in selenium-bearing and selenium-free areas of its range.	10.0%	\$13,860.00		\$7,250.00	\$4,220.00	\$2,035.00	\$27,355.00
Multi Year Tasks								
15	Data reduction, validation and reporting, and publication	7.5%	\$10,694.00	\$5,459.00	\$2,000.00	\$1,850.00	\$1,132.00	\$21,135.00
16	Project management	7.5%	\$10,694.00			\$3,350.00	\$1,283.00	\$16,327.00
		100%	\$139,740.00	\$291,318.00	\$57,640.00	\$16,970.00	\$20,415.00	\$626,083.00

I-018837

I-018837

Table 4. Quarterly Budget Breakdown

Task	Oct-Dec 99	Jan-Mar 00	Apr-Jun 00	Jul-Sep 00	Oct-Dec 00	Jan-Mar 01	Apr-Jun 01	Jul-Sep 01	Oct-Dec 01	Jan-Mar 02	TOTAL
1	1,352	1,352	1,352	1,352							\$5,4008
2	2,042	2,042	2,042	2,041							\$8,167
3	34,736	34,736	34,735	34,735							\$138,942
4	6,581	6,581	6,581	6,580							\$26,323
5 & 14	6,244	6,243	6,243	6,243	6,244	6,243	6,243	6,243	6,244	6,244	\$62,434
6 & 13	1,901	1,901	1,901	1,901	1,901	1,901	1,901	1,901	1,902	1,902	\$19,012
7	1,155	1,155	1,155	1,155							\$4,620
8	3,258	3,258	3,258	3,257							\$13,031
9	3,533	3,533	3,533	3,533							\$14,131
10					27,358	27,358	27,358	27,358	27,358	27,358	\$164,148
11					1,009	1,009	1,008	1,008	1,008	1,008	\$6,050
12					4,560	4,559	4,559	4,559	4,559	4,559	\$27,355
15	2,114	2,114	2,114	2,114	2,114	2,113	2,113	2,113	2,113	2,113	\$21,135
16	1,533	1,533	1,533	1,533	1,533	1,533	1,533	1,532	1,532	1,532	\$15,327
Total	64,449	64,448	64,447	64,443	44,719	44,716	44,715	44,714	44,716	44,716	\$526,083

UC DAVIS BUDGET

	Percent Effort	Salary Requested	Benefits Requested	Total Requested
University of California, Davis Personnel				
Mari Wolfe, Principal Investigator	50%	\$ 22,450	\$ 3,817	\$ 26,267
Graduate Research Assistant	50%	\$ 13,788	\$ 179	\$ 13,967
To be named, Staff Research Associate	25%	\$ 6,867	\$ 1,579	\$ 8,446
Business Office, Administrative Asst.	3%	\$ 750	\$ 173	\$ 923
Sub-total Personnel				\$ 49,603
Travel				
Field Mileage and Per Diem (@ \$.315)				\$ 1,000
Sub-total Travel				\$ 1,000
Equipment				
Platereader				\$ 22,000
Computer				\$ 2,000
Microscope				\$ 7,500
Sub-total Equipment				\$ 31,500
Supplies				
Laboratory/Photo Supplies				\$ 3,500
Snake Purchase				\$ 720
Animal Food, Supplies/Containers				\$ 1,100
Animal Care				\$ 1,710
Biochemicals and Reagents				\$ 2,400
Sub-total Supplies				\$ 9,430
Contractual				
USF&WS				\$ 136,442
Consultant, Swee Teh				\$ 4,200
				\$ 140,642
Other				
Fee Remission for Graduate Student				\$ 4,466
Facility Charges for Animal Rooms				\$ 1,500
Waste Disposal				\$ 200
Communication Costs				\$ 1,080
Office Costs, Copying				\$ 650
Subtotal Other Costs				\$ 7,896
Total Direct Costs				\$ 240,071
Total Modified Direct Costs				\$ 92,663
State Indirect Cost Rate @ 10%				9,266
Total Cost				\$ 249,337

Revised 4/12/99

Budget Yr 2

UC DAVIS BUDGET

	Percent Effort	Salary Requested	Benefits Requested	Total Requested
University of California, Davis Personnel				
Marti Wolfe, Principal Investigator	50%	\$ 23,350	\$ 3,970	\$ 27,320
Graduate Research Assistant	50%	\$ 13,788	\$ 179	\$ 13,967
To be named, Staff Research Associate	25%	\$ 7,210	\$ 1,658	\$ 8,868
Business Office, Administrative Asst.	3%	\$ 775	\$ 178	\$ 953
Sub-total Personnel				\$ 51,108
Travel				
Field Mileage and Per Diem (@ \$.315)				\$ 1,000
Sub-total Travel				\$ 1,000
Supplies				
Laboratory/Photo Supplies				\$ 3,500
Animal Food/Supplies				\$ 1,100
Animal Care				\$ 1,710
Selenium Analysis Supplies				\$ 4,200
Hematology Profiles				\$ 2,220
Biochemicals and Reagents				\$ 2,400
Sub-total Supplies				\$ 15,130
Contractual				
USF&WS				\$ 139,717
Consultant, Swee Teh				\$ 5,500
				\$ 145,217
Other				
Fee Remission for Graduate Student				\$ 4,466
Facility Charges for Animal Rooms				\$ 1,500
Waste Disposal				\$ 200
Communication Costs				\$ 1,080
Office Costs, Copying				\$ 650
Subtotal Other Costs				\$ 7,896
Total Direct Costs				\$ 220,351
Total Modified Direct Costs				\$ 76,168
State Indirect Cost Rate @ 10%				7,617
Total Cost				\$ 227,968

Revised 4/12/99

Budget Yr 3 (6 months)

UC DAVIS BUDGET

	Percent Effort	Salary Requested	Benefits Requested	Total Requested
University of California, Davis Personnel				
Marti Wolfe, Principal Investigator	50%	\$ 11,675	\$ 1,985	\$ 13,660
Graduate Research Assistant	50%	\$ 6,894	\$ 90	\$ 6,984
To be named, Staff Research Associate	25%	\$ 3,605	\$ 829	\$ 4,434
Business Office, Administrative Asst.	3%	\$ 450	\$ 104	\$ 554
Sub-total Personnel				\$ 25,631
Travel				
Field Mileage and Per Diem (@ \$.315)				\$ 2,000
Sub-total Travel				\$ 2,000
Supplies				
Laboratory/Photo Supplies				\$ 1,000
Selenium Analysis Supplies				\$ 2,100
Histology Supplies				\$ 1,000
Biochemicals and Reagents				\$ 1,200
Sub-total Supplies				\$ 5,300
Contractual				
USF&WS				\$ 5,459
Consultant, Swee Teh				\$ -
				\$ 5,459
Other				
Fee Remission for Graduate Student				\$ 4,466
Communication Costs				\$ 540
Publication Costs				\$ 1,200
Office Costs, Copying				\$ 650
Subtotal Other Costs				\$ 6,856
Total Direct Costs				\$ 45,246
Total Modified Direct Costs				\$ 35,321
State Indirect Cost Rate @ 10%				3,532
Total Cost				\$ 48,778

Revised 4/12/99



IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

FWS/BC-99-036

April 9, 1999

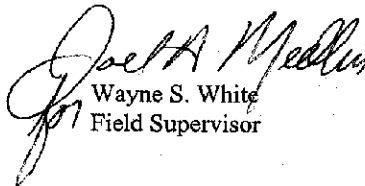
Dr. Marti Wolfe
University of California
Institute of Toxicology & Environmental Health
One Shields Avenue
Davis, CA 95616-8615

Subject: CALFED Proposal on the Effects of Dietary Selenium on Giant Garter Snakes

We support you in submitting a proposal to investigate "Impacts of Dietary Selenium on Giant Garter Snake Populations in the Sacramento-San Joaquin Watershed."

If the proposal is successful we would be pleased to work with you during the planning and implementation phase. If you have any questions or concerns please, contact Dr. William Beckon of our Environmental Contaminants Division, at (916) 979-2110.

Sincerely,


Wayne S. White
Field Supervisor

USFWS Budget

Impacts of Dietary Selenium on Giant Garter Snake Populations in the
Sacramento-San Joaquin Watershed

Garter snakes eat 20% of body wt per week in fish (Rossman et al, 1996)
 Average snake weight about 100 gm (male ~60 gm, female ~140 gm) (Wolfe pers. com.)
 Average wt of mosquitofish 0.5 gm (0.2-0.8 gm) (USFWS field data from Grassland Bypass
 Project monitoring Mar 31, 1999)
 Each snake needs 20 gm = 40 mosquitofish per week, 520 mosquitofish per quarter (13 wks)
 3 biologists seine about 600 fish per day in sloughs/drain (200 fish per biologist day).
 2.6 biologist days per quarter needed to catch fish for each snake.

To maintain 24 snakes on wild-caught fish:

24 snakes X 2.6 biologist days/snake/quarter = 62 biologist days/quarter

Personnel costs /quarter = 62 biologist days /quarter X \$530/biologist day = \$33,072

Year 1

FWS Personnel

Catching fish for 24 snakes

\$132,288

Travel

included in personnel

\$0

Supplies

Dry ice 60 lbs/quarter @\$0.75/lb

\$180

Overhead @ 3%

\$3,974

Total Year 01

\$136,442

Year 2

FWS Personnel

Catching fish for 24 snakes

\$132,288

Catching 12 snakes (6 biologist days @\$530)

\$3,180

Travel

included in personnel

\$0

Supplies

Dry ice 60 lbs/quarter @\$0.75/lb

\$180

Overhead @ 3%

\$4,069

Total Year 02

\$139,717

Year 3 (6 months)

FWS Personnel

Report writing (10 biologist days@\$530)

\$5,300

Overhead @ 3%

\$ 159

Total Year 03

\$ 5,459

Total

\$281,618

RESUME

Marti F. Wolfe, Ph.D.

Mailing Address: Institute of Toxicology and Environmental Health
University of California
One Shields Avenue
Davis, CA 95616-8615

Research/Professional Background

4/85-8/86 Environmental Health and Safety Consultant, Fowler Associates
9/84-6/85 and 9/78-6/79 Instructor, San Jose State University
1/90-12/92 Toxicologist and Industrial Hygiene Technician, Prezant Associates, Inc.
5/86-6/92 Graduate Research Assistant, Institute of Wildlife and Environmental Toxicology, Clemson S.C.
12/92-2/94 Project Scientist, Mantech Environmental Technology, USEPA Environmental Research Lab, Corvallis, OR
6/95-present Faculty Research Assistant, Agricultural Chemistry Department, Oregon State University
1/92- present Toxicologist and Partner, Toxicology Task Force, Philomath, OR

Education

University of California, Berkeley	B.S.	1974	Conservation
San Jose State University, San Jose	M.A.	1976	Biological Sciences
Washington State University, Pullman, WA	Ph.D.	1992	Pharmacology/Toxicology

Honors

Dean's List, UC Berkeley
M. J. Sharp Memorial Award for Outstanding Undergraduate Women

Selected Publications

Wolfe, M. F. Estimation of waterborne concentrations of contaminants that are thresholds for adverse effects in wildlife: Mercury. Final Research Report to Office of Water, U.S. EPA, to be published as a volume in the series Case Studies in Ecological Risk Assessment, 1998.

Wolfe, M. F., and R.J. Kendall. 1998 The Age-dependent toxicity and comparative metabolism of diazinon and terbufos in European starlings (*Sturnus vulgaris*) and red-winged blackbirds (*Agelaius phoeniceus*) Environ. Toxicol. Chem. 17:1300-1312.

Wolfe, M. F., J. White and C. Simpson. 1998. Comparison of benzo[a]pyrene exposure in birds using CYP1A1 induction and bile metabolites: development of a non-lethal measure. Toxicol. Sci. 42S:23.

Wolfe, M. F. and D. M. Norman 1998. Effects of waterborne mercury on wildlife at Clear Lake: Evaluation and field-testing of a predictive model. Environ. Toxicol. Chem. 17:214-227.

Wolfe, M. F., S. Schwarzbach and R.A. Sulaiman. 1998. Effects of waterborne mercury on wildlife: A comprehensive review. Environ. Toxicol. Chem. 17:146-160

- White, J. and Wolfe, M. 1997. Earthquakes and oil spills: lessons from the Santa Clara River spill. Proceedings of the 1997 International Oil Spill Conference. Fort Lauderdale, FL, Apr. 7 - 10, 1997. pp. 1038- 1039.
- Wolfe, M.F. and D.M Norman. 1997. Monitoring uptake of contaminants from tar sands effluent in wetlands using mallard ducklings. Society of Environmental Toxicology and Chemistry 18th Annual Meeting, San Francisco CA, Nov. 16 - 20.
- Wolfe, M. F. and D. M. Norman. 1995. Uptake of water-borne contaminants by ducklings exposed via constructed wetlands. Final Report for EVS Consultants and Suncor Oil Sand Group.
- Wolfe, M.F. 1994. Estimation of Waterborne Concentrations of Contaminants that are Thresholds for Adverse Effects in Wildlife: Mercury. Interim Research Report to Office of Water, U.S. EPA.
- Purlong, C.E., R. Humbert, C. Hassett, C.J. Omiecinski and M.F. Wolfe. 1993 Molecular Basis of the Genetic Variability of Human Paraoxonase. The Toxicologist, abstracts of the 1992 Society of Toxicology Annual Meeting.

Publications In Preparation

- Wolfe, M.F. 1999. The role of cholinesterase kinetics in the toxicity of terbufos and diazinon to red-winged blackbirds and European starlings. *submitted*
- Wolfe, M.F., J. M. Funsch, D. Dix, and R. J. Kendall. 1999. Behavioral toxicity of terbufos in three species of passerine birds. *In preparation*
- Wolfe, M.F., and R.J. Kendall. 1999. Hepatic microsomal activation of terbufos and diazinon in red-winged blackbirds and European starlings. *In preparation*
- Wolfe, M.F., and R.J. Kendall. 1999. Carboxylesterase activities of adult and nestling redwinged blackbirds and European starlings. *In preparation*

Graduate and Postdoctoral Advisors and Advisees

- Ann Fairbrother, US Environmental Protection Agency/EP&T, Inc. (Postdoctoral Advisor)
- Ronald Kendall, Texas Tech (Thesis Advisor)

List of Collaborators Within Last 48 Months

- Donald M. Norman, Louisiana State University
- Steve Schwarzbach, US Fish & Wildlife Service
- Chris Simpson, University of British Columbia/University of Minnesota
- Jan White, Arizona Game & Fish

CURRICULUM VITAE

William N. Beckon

Work Address

U.S. Fish and Wildlife Service
3310 El Camino Avenue, Suite 130
Sacramento, CA 95821-6340

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1700 Madrone Lane
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U.S.A.

Work Phone (916) 979-2112 Ext. 417

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Home Phone (530) 757-6355 or 753-8262

Electronic mail William_Beckon@mail.fws.gov

EDUCATION

1990 Ph.D. in Zoology, University of California, Davis, Calif.
1988 M.A. in Zoology, University of California, Davis, Calif.
1971 B.A. cum laude in Physics, Pomona College, Claremont, Calif.

HONORS AND AWARDS

1996 Special Act Service Award, U.S. Fish and Wildlife Service
1995 On-the-Spot Award, U.S. Fish and Wildlife Service
1992-1994 National Science Foundation Fellowship (Japan Program)
1989-1990 The Explorers Club Exploration Fund grant
1988-1989 Jastro-Shields Research Scholarship
1987-1988 Frank M. Chapman Grant
1986-1987 Earle C. Anthony Fellowship
1986-1987 U.C. Davis Graduate Research Award
1986-1987 Jastro-Shields Research Scholarship
1985-1986 U.C. Davis Graduate Research Award
1985-1986 University of California Regent's Fellowship

WILDLIFE CONSERVATION/MANAGEMENT EXPERIENCE

1996-present Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Environmental Contaminants Division, Sacramento, California. Lead a team of refuge biologists and contaminants specialists that monitors fish and wildlife resources on the San Luis National Wildlife Refuge Complex in the western San Joaquin Valley to insure that the ecosystem is not harmed by agricultural drainwater. Conduct preacquisition surveys.

1994-1996 Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Endangered Species Division, Sacramento, California. Negotiated conservation measures to avoid or compensate for degradation and destruction of habitat of federally listed (endangered and threatened) species in compliance with the Endangered Species

Act. Reviewed environmental impact assessments.

TEACHING EXPERIENCE

- 1999 Instructor, California State University, Sacramento, for the upper division course:
Laboratory Investigations in Biology (two sections)
- 1990, 1991 Instructor, University of California, Davis, for the upper division course:
Phylogenetic Analysis of Vertebrate Structure.
- 1983-1989 Teaching assistant, University of California, Davis, for the following:
Laboratory in General Zoology: 1983-1985, 1987, 1988
Principles of Biology: 1984, 1989
Functional Analysis of Vertebrate Structure: 1985
Phylogenetic Analysis of Vertebrate Structure: 1986, 1987
- 1973-1974 Peace Corps Volunteer teacher of biology, mathematics, basic science, physics; head
of mathematics department, All Saints High School, Labasa, Fiji.

FIELD RESEARCH EXPERIENCE

- 1992-1994 Planned, organized, secured funding for, and completed a two-year survey of the
distribution of land birds in the Ryukyu archipelago, south of Japan. The survey
was supported by a National Science Foundation fellowship.
- 1985-1989 Planned, organized, and carried out four expeditions to survey the land birds of the
least known and most remote islands of the Fiji Archipelago in the S. W. Pacific.
Each expedition was about four months in duration. Comprehensively surveyed
more than 220 islands.
- 1975-1978 Conceived, organized, and completed a comprehensive study of the wildlife of the
Fiji Islands. Secured the sponsorship of the Fiji Education Department, the
National Trust for Fiji, and the U. S. Peace Corps for this project. The study
culminated in coauthorship of a 400-page resource book for use in Fiji schools.
The book summarized all that is known of the biology of the terrestrial vertebrates
of Fiji. It is abundantly illustrated with original photographs, drawings, and range
maps. In the course of field work for this study, I discovered a rare new species of
fruit bat belonging to a little-known genus in remote montane rainforest on one of
the islands. Coauthored the original description of this species.

CONSULTING EXPERIENCE

- 1992 Surveyed snakes in remnant wetlands of the Central Valley of California to assess the
status and distribution of the endangered giant garter snake. Worked for Beak
Consultants Inc., 2717 Cottage Way, Suite 20, Sacramento, CA 95825.

- 1977 Compiled an environmental impact report for the Fiji Government on the proposed Monasavu Hydroelectric Scheme. In support of the report, surveyed the birds of the rainforest near Monasavu Falls, Vitilevu, Fiji.
- 1976-1977 Compiled an environmental impact report for the AMAX mining consortium on a prospective copper mine at Waisoi Creek, Namosi, Fiji. The report included a field survey of the terrestrial vertebrates in the vicinity of the proposed mine site.

PUBLICATIONS

- Beckon, W. N., M. Dunne, J. D. Henderson, J. P. Skorupa, S. E. Schwarzbach, and T. C. Maurer. 1998. Biological effects of the reopening of the San Luis Drain to carry subsurface irrigation drainwater. Appendix E in *Grassland Bypass Project Annual Report October 1, 1996 through September 30, 1997*. U. S. Bureau of Reclamation, Sacramento, California.
- Beckon, W. N. 1993. The effect of insularity on the diversity of land birds in the Fiji islands: implications for refuge design. *Oecologia* 94:318-329.
- Beckon, W. N. 1992. The giant Pacific geckos of the genus *Gehyra*: morphological variation, distribution and biogeography. *Copeia* 1992:443-460.
- Beckon, W. N. 1990. Patterns of colonization and distribution, the species-area relation, and other aspects of the biogeography of island vertebrates, with particular reference to the Fiji archipelago. (Ph.D. dissertation) University Microfilms International, Ann Arbor, Michigan.
- Beckon, W. N. 1990. First record of the Pectoral Sandpiper in Fiji. *Notornis* 37:106.
- Beckon, W. N. 1989. An undescribed form of owl in Fiji. *Notornis* 36:114-116.
- Beckon, W. N. 1987. Evidence of cooperative nest-excavation in the White-collared Kingfisher (*Halcyon chloris*) in Fiji. *Ibis* 129:391-392.
- Beckon, W. N. 1982. A breeding record of the Whistling Dove of Kadavu, Fiji. *Notornis* 29:1-7.
- Beckon, W. N. 1980. Gizzard structure of the Pacific Pigeon, *Ducula pacifica*. *Notornis* 27:302-303.
- Beckon, B. and R. Beckon. 1978. Fiji Scarlet Robin eating worms on the ground. *Notornis* 25:154-156.
- Hill, J. E. and W. N. Beckon. 1978. A new species of *Pteralopex* Thomas, 1888 (Chiroptera: Pteropodidae) from the Fiji Islands. *Bull. Br. Mus. Nat. Hist. (Zool.)* 34:65-82.

CONTINUING EDUCATION COURSES TAKEN

- 1998 (Oct.) Environmental Contaminants Field and Lab Techniques, 40 hours, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1998 (Sep.) Sampling Design for Field Studies, 40 hours, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1998 (May) Land Preacquisition Contaminants Survey: FWS Level 1 Procedures, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1998 (Mar.) Health and Safety Training for Hazardous Waste Workers, 40 hours, University of California.
- 1997 (Oct.) Principles and Techniques of Electrofishing, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1997 (Aug.) Water Quality Standards Academy, 40-hour course, United States Environmental Protection Agency.
- 1997 (May) An Approach to Ecosystem Conservation, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1997 (Mar.) Principles of Environmental Toxicology, 40-hour course, National Conservation Training Center, U. S. Fish and Wildlife Service.
- 1996 (Nov.) Natural History and Management of Bats in California and Nevada, 3-day workshop presented by the Western Section of the Wildlife Society.
- 1996 (Oct.) Complex Environmental Negotiations, National Education and Training Center, U. S. Fish and Wildlife Service.
- 1996 (Sep.) Writing NEPA [National Environmental Policy Act] Documents, National Education and Training Center, U. S. Fish and Wildlife Service.
- 1996 (Aug.) Planning Sustainable Conservation Projects, Center for Natural Lands Management.
- 1996 (Jun.) Ecology, Conservation, and Management of Vernal Pool Ecosystems, California Native Plant Society.
- 1996 (Feb.) Wetland Soils and Hydrology, National Education and Training Center, U. S. Fish and Wildlife Service.
- 1995 (Aug.) Endangered Species Act, Section 7: Consultations, National Education and Training Center, U. S. Fish and Wildlife Service.
- 1995 (Apr.) Endangered Species Act, Section 10: Habitat Conservation Planning, National Education and Training Center, U. S. Fish and Wildlife Service.
- 1995 (Feb.) Natural Resources Negotiation and Decision Making, Colorado State University.

KIRK C. KLASING
PROFESSOR OF AVIAN BIOLOGY

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SOCIAL SECURITY# 307-66-8838 **BIRTH DATE:** 11/11/55

EDUCATION

1979-1982	Ph.D.	Cornell University	Nutritional Biochemistry
1977-1979	M.S.	Purdue University	Animal Science
1973-1977	B.S.	Purdue University	Agricultural Sciences

EMPLOYMENT

September 1998 – present. Professor of Avian Nutrition, Department of Animal Science, University of California, Davis, CA
January 1997 – June 1998. Professor and Chair, Department of Avian Sciences, University of California, Davis, CA
August 1991 – December 1996. Professor of Avian Nutrition, Department of Avian Sciences, University of California, Davis, CA
July 1987 - July, 1991. Associate Professor, Department of Avian Sciences, University of California, Davis, CA
Sept 1985 - June 1988. Assistant Professor, Department of Avian Sciences, University of California, Davis, CA
Jan 1985 - Aug 1985. Sabbatical leave, Human Nutrition and Nonruminant Animal Nutrition Labs, USDA, Beltsville, MD
1982 - Aug 1985. Assistant Professor of Animal Science, University of Illinois, Champaign, IL

TOTAL PUBLICATIONS: 75 refereed; 115 non-refereed; 6 book chapters; 1 book: Comparative Avian Nutrition.

CURRICULUM VITAE

TEH, SWEE JOO, Ph.D.

Toxicopathology Consulting (President)

1302 Locust Place, Davis, CA. 95616

Phone: (530) 753-1950, (530) 400-7974

Fax: (530) 753-1950, E-mail: toxicopathology@netscape.net

SPECIALTY: Research & Environmental Toxicopathologist

Write grants and contract proposals. Experience in acute and chronic toxicity, carcinogenesis, and endocrine disruptors' study in fish using biochemical, pathological, physiological, stereological, and ultrastructural analysis. Application of histopathologic biomarkers in assessing & evaluating the deleterious effects of environmental contaminants & endocrine disruptors on resident fish & shellfish population. Developing & incorporating enzyme- & immuno-histochemistry methods & techniques for use in histopathologic biomarkers work. Integration of histopathologic biomarkers with biomarkers at other levels of biological organization to determine the health of the ecosystems. Experiences in experimental designed and maintaining exposed animals (>2000) for biomarkers approach. Write and submit final reports to contract manager. Published research findings in respective scientific journals.

PUBLICATIONS (11 of 22):

1. Braunbeck, T., Teh, S.J., Lester, S.M. and Hinton, D.E. Ultrastructural alterations in hepatocytes of medaka (*Oryzias latipes*) exposed to diethylnitrosamine. *Toxicol. Pathol.* 20:179-196. 1992.
2. Teh, S.J. and Hinton, D.E. Detection of enzyme histochemical markers of hepatic preneoplasia and neoplasia in medaka (*Oryzias latipes*). *Aquat. Toxicol.* 24:163-182. 1993.
3. Lester, S.M., Braunbeck, T.A., Teh, S.J., Stegeman, J.J., Miller, M.R. and Hinton, D.E. Hepatic cellular distribution of cytochrome P-450 1A1 in rainbow trout (*Oncorhynchus mykiss*): an immunohisto- and cytochemical study. *Cancer Res.* 53:3701-3706. 1993.
4. Gawlicka, A., Teh, S.J., Hung, S.S.O., Hinton, D.E. and de la Noüe, J. Histological and histochemical changes in the digestive tract of white sturgeon larvae during ontogeny. *Fish Physio. Biochem.* 14:357-371. 1995.
5. Teh, S.J. Cellular aspects of hepatocarcinogenesis in medaka (*oryzias latipes*): dynamics of histogenesis and gender-related sensitivity. Dissertation. 175 pages. 1996.
6. Teh, S.J., Adams, S.M. and Hinton, D.E. Histopathologic biomarkers of anthropogenic stress in resident redbreast sunfish (*Lepomis auritus*) and largemouth bass (*Micropterus salmoides* Lacépède) from contaminant impacted sites. *Aquat. Toxicol.* 37: 51-70. 1997.
7. Teh, S.J. and Hinton, D.E. Protecting Malaysia's aquatic resources: Biomarkers of exposure and effect in resident fishes. Malaysia Science & Technology Congress, 1997.
8. Teh, S.J. and Hinton, D.E. Gender-specific growth and hepatic neoplasia in medaka (*Oryzias latipes*). *Aquat. Toxicol.* 41: 141-159. 1998.
9. Teh, S.J. and Hinton, D.E. Application of biomarkers in assessing and evaluating the effects of environmental contaminants on resident fishes. 2nd International Conference on Marine Pollution & Ecotoxicology. Jun 10-14, 1998.
10. Adams, S.M., Bevelhimer, M.S., Greeley, M.S., Levinc, D.A. and Teh, S.J. Ecological Risk Assessment in a Large River-Reservoir: 6. Bioindicators of Fish Population Health. *Environmental Toxicology & Chemistry*, Vol 18, 4:628-640. 1999.
11. Teh, S.J., Clark, S.L., Brown, C. and Hinton, D.E. Enzymatic and histopathologic biomarkers as indicator of environmental contaminant exposure and effect in Asian clam (*Potamocorbula amurensis*). Bivalve Biomarkers Workshop. In press.



INSTITUTE OF TOXICOLOGY AND
ENVIRONMENTAL HEALTH
(530) 752-1340
FAX: (530) 752-5300

ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8615

April 14, 1999

Merced County Board of Supervisors
2222 M Street
Merced, CA 95340

Dear Board Members:

This letter is to notify you of our intent to submit a proposal entitled "Impacts of Dietary Selenium on Giant Garter Snake Populations in the Sacramento-San Joaquin Watershed" to the CALFED Bay Delta Program.

If funded this proposal would start October 1, 1999. Please feel free to contact me if you have any questions or concerns. I may be reached by telephone at (530) 754-8536 or by facsimile (530) 752-5300 or e-mail mfwolfe@ucdavis.edu.

Sincerely,

Marti F. Wolfe

Marti F. Wolfe, Ph.D.



INSTITUTE OF TOXICOLOGY AND
ENVIRONMENTAL HEALTH
(530) 752-4340
FAX: (530) 752-5300

ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8615

April 14, 1999

Planning and Community Development
2222 M Street
Merced, CA 95340

To Whom It May Concern:

This letter is to notify you of our intent to submit a proposal entitled "Impacts of Dietary Selenium on Giant Garter Snake Populations in the Sacramento-San Joaquin Watershed" to the CALFED Bay Delta Program.

If funded this proposal would start October 1, 1999. Please feel free to contact me if you have any questions or concerns. I may be reached by telephone at (530) 754-8536 or by facsimile (530) 752-5300 or e-mail mfwolfe@ucdavis.edu.

Sincerely,

Marti F. Wolfe

Marti F. Wolfe, Ph.D.

Attachment D
Terms and Conditions for State (CALFED) Funds

This section provides contract terms and conditions applicable to contracts issued under State (CALFED) funds. The specific terms and conditions may vary, depending on the applicant category (State entities, Federal and other public entities, non-profit organizations, and private entities), and the type of project (Public Works/Construction or Services), as identified in Table D-1. Specific documents that should be submitted with the proposal are shown in Table D-1.

The general terms and conditions which will apply to Category III contracts funded with Proposition 204 funding are provided below.

In addition to these general terms and conditions, specific additional standard clauses will be applicable depending on the type of project and applicant category. Table D-1 provides a summary of those standard clauses for different types of projects and different applicant categories. Those standard clauses are provided at the end of this attachment.

1. **Term of Contract:** The term of the agreement will be dependent on the project and may range from 1 to 3 years. The agreement shall not become effective until fully executed by the parties and approved by the Department of General Services.
2. **Payment Schedule:** No funds will be disbursed by State or National Fish and Wildlife Foundation (NFWF) to Contractor without 1) an executed copy of the Contract, 2) receipt of an original invoice with supporting documentation, and 3) receipt and satisfactory completion of deliverables and/or phases of work as set forth in the agreement, including quarterly financial and programmatic reports. Payments shall be in arrears within 30 days of receipt of invoice by CALFED.
3. **Budget Variances:** Variances which exceed ten percent of a project task's approved budgeted amount should have approval in advance, with written explanations of programmatic changes to cover such variances but must remain within the maximum contract amount.
4. **Subcontracts:** Contractors are responsible for all subcontracted work. Subcontract terms and conditions must include all applicable contract terms and conditions as presented herein. Subcontractor agreements require approval by the State or NFWF, unless the subcontract was included and approved as part of the main proposal. Any amendments to subcontract must be approved by the State or NFWF. In obtaining subcontracts, contractor must obtain at least 3 competitive bids for all subcontracted work, or comply with the provisions of Government Code Section 4525 et seq., if applicable, or submit written justification for and obtain the State's or NFWF's approval of non-compliance with these requirements.
5. **Substitution:** Should the State or NFWF be dissatisfied with the work of subcontractors or employees of the contractor, the State or NFWF may require the contractor to substitute different qualified subcontractors or employees. The State or NFWF must approve such substitutions in advance of providing applicable services.
6. **Conflict of Interest:** Contractor shall comply with all applicable State laws and rules pertaining to conflict of interest, including but not limited to Government Code 1090 and Public Contract Code 10410 and 10411.
7. **Standard of Professionalism:** Contractor shall conduct all work consistent with the professional standards for the industry and type of work being performed under the contract.
8. **Rights in Data:** All data and information obtained and/or received under contract shall be in the public domain. Contractor shall have the right to disclose, disseminate and use, in whole or part, any

final form data and information received, collected and developed under this agreement, subject to inclusion of appropriate acknowledgment of credit to the State or NFWF, CALFED, and all cost sharing partners for their financial support. Use of draft data requires pre-approval by State or NFWF and CALFED. Contractor shall not sell or grant rights to a third party who intends to sell such product as a profit-making venture.

9. Indemnification: The Contractor agrees to indemnify, defend and hold harmless the CALFED agencies, the State of California, the Resources Agency, Department of Water Resources, and National Fish and Wildlife Foundation and their officers, agents and employees from any and all claims and losses accruing or resulting to any or all contractors, subcontractors, material persons, laborers, and any other person, firm or corporation furnishing or supplying work services, materials or supplies in connection with the performance of this contract, and from any and all claims and losses accruing or resulting to any person, firm or corporation who may be injured or damaged by the Contractor in the performance of this contract.

10. Independent Status: The Contractor, and the officers, agents and employees of Contractor, in the performance of the contract, shall act in an independent capacity and not as officers or employees or agents of the State of California, NFWF, CALFED Agencies, the Resources Agency, or Department of Water Resources.

11. Termination Clause: The State or NFWF may terminate this agreement and be relieved of the payment of any consideration to Contractor should Contractor fail to perform the covenants herein contained at the time and in the manner herein provided. In the event of such termination the State or NFWF may proceed with the work in any manner deemed proper by the State. The cost to the State shall be deducted from any sum due the Contractor under this agreement, and the balance, if any shall be paid the Contractor upon demand.

12. Assignment: Without the written consent of the State, this agreement is not assignable by Contractor either in whole or in part.

13. Integration Clause: No alteration or variation of the terms of this contract shall be valid unless made in writing and signed by the parties hereto, and no oral understanding or agreement not incorporated herein, shall be binding on any of the parties hereto. This contract may be amended upon mutual written agreement of the parties and approved by State or NFWF and CALFED.

14. Consideration: The consideration to be paid Contractor as provided herein, shall be in compensation for all of the Contractor's expenses incurred in the performance hereof, including travel and per diem, unless otherwise expressly so provided.

15. Dispute Resolution: Any claim that Contractor may have regarding the performance of this agreement including, but not limited to, claims for additional compensation or extension of time, shall be submitted to the Executive Director, CALFED, within thirty days of its accrual, CALFED and Contractor shall then attempt to negotiate a resolution of claim and process an amendment to this agreement to implement the terms of any such resolution.

16. Time is of the essence in this agreement.

**STANDARD CLAUSES -
CONTRACTS WITH PUBLIC ENTITIES**

Workers' Compensation Clause. Contractor affirms that it is aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code, and Contractor affirms that it will comply with such provisions before commencing the performance of the work under this contract.

Nondiscrimination Clause. During the performance of this contract, the recipient, Contractor and its subcontractors shall not deny the contract's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, mental disability, medical condition, marital status, age (over 40), or sex. Contractor shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination. Contractor shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.), the regulations promulgated thereunder (California Administrative Code, Title 2, Sections 7285.0 et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code Sections 11135 - 11139.5), and the regulations or standards adopted by the awarding State agency to implement such article. Contractor or recipient shall permit access by representatives of the Department of Fair Employment and Housing and the awarding State agency upon reasonable notice at any time during the normal business hours, but in no case less than 24 hours' notice, to such of its books, records, accounts, other sources of information and its facilities as said Department or Agency shall require to ascertain compliance with this clause. Recipient, Contractor and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. The Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

Availability of Funds. Work to be performed under this contract is subject to availability of funds through the State's normal budget process.

Audit Clause. For contracts in excess of \$10,000, the contracting parties shall be subject to the examination and audit of the State Auditor for a period of three years after final payment under the contract. (Government Code Section 8346.7).

Payment Retention Clause. Ten percent of any progress payments that may be provided for under this contract shall be withheld per Public Contract Code Sections 10346 and 10379 pending satisfactory completion of all services under the contract.

Reimbursement Clause. If applicable, travel and per diem expenses to be reimbursed under this contract shall be at the same rates the State provides for unrepresented employees in accordance with the provisions of Title 2, Chapter 3, of the California Code of Regulations. Contractor's designated headquarters for the purpose of computing such expenses shall be: _____

Drug-Free Workplace Certification. By signing this contract, the Contractor or grantee hereby certifies under penalty of perjury under the laws of the State of California that the Contractor or grantee will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government Code Section 8350 et seq.) and will provide a drug-free workplace by taking the following actions:

1. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.
2. Establish a Drug-Free Awareness Program to inform employees about all of the following:
 - (a) The dangers of drug abuse in the workplace,
 - (b) The person's or organization's policy of maintaining a drug-free workplace,
 - (c) Any available counseling, rehabilitation and employee assistance programs, and
 - (d) Penalties that may be imposed upon employees for drug abuse violations.
3. Every employee who works on the proposed contract or grant:
 - (a) Will receive a copy of the company's drug-free policy statement, and
 - (b) Will agree to abide by terms of the company's statement as a condition of employment on the contract or grant.

This contract or grant may be subject to suspension of payments or termination, or both, and the Contractor or grantee may be subject to debarment if the department determines that: (1) the Contractor or grantee has made a false certification, or (2) the Contractor or grantee violates the certification by failing to carry out the requirements noted above.

Americans With Disabilities Act. By signing this contract, Contractor assures the State that it complies with the Americans With Disabilities Act (ADA) of 1990, (42 U.S.C. 12101 et seq.), which prohibits discrimination on the basis of disability, as well as all applicable regulations and guidelines issued pursuant to the ADA.

Former State Employees. a) For the two-year period from the date he or she left State employment, no former State officer or employee may enter into a contract in which he or she engaged in any of the negotiations, transactions, planning, arrangements or any part of the decision-making process relevant to the contract while employed in any capacity by any State agency. b) For the twelve-month period from the date he or she left State employment, no former State officer or employee may enter into a contract with any State agency if he or she was employed by that State agency in a policy-making position in the same general subject area as the proposed contract within the twelve-month period prior to his or her leaving State service.

STANDARD CLAUSES -**SERVICE & CONSULTANT SERVICE CONTRACTS FOR \$5,000 & OVER WITH NONPUBLIC ENTITIES**

Workers' Compensation Clause. Contractor affirms that it is aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code, and Contractor affirms that it will comply with such provisions before commencing the performance of the work under this contract.

National Labor Relations Board Clause. In accordance with Public Contract Code Section 10296, Contractor declares under penalty of perjury that no more than one final, unappealable finding of contempt of court by a federal court has been issued against the Contractor within the immediately preceding two-year period because of Contractor's failure to comply with an order of a federal court which orders Contractor to comply with an order of the national Labor Relations Board.

Nondiscrimination Clause. During the performance of this contract, the recipient, Contractor and its subcontractors shall not deny the contract's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, mental disability, medical condition, marital status, age (over 40), or sex. Contractor shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination. Contractor shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.), the regulations promulgated thereunder (California Administrative Code, Title 2, Sections 7285.0 et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code Sections 11135 - 11139.5), and the regulations or standards adopted by the awarding State agency to implement such article. Contractor or recipient shall permit access by representatives of the Department of Fair Employment and Housing and the awarding State agency upon reasonable notice at any time during the normal business hours, but in no case less than 24 hours' notice, to such of its books, records, accounts, other sources of information and its facilities as said Department or Agency shall require to ascertain compliance with this clause. Recipient, Contractor and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. The Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

Statement of Compliance. The Contractor's signature affixed hereon and dated shall constitute a certification under penalty of perjury under the laws of the State of California that the Contractor has, unless exempted, complied with the nondiscrimination program requirements of Government Code Section 12990 and Title 2, California Code of Regulations, Section 8103.

Performance Evaluation. For consulting service agreements, Contractor's performance under this contract will be evaluated after completion. A negative evaluation will be filed with the Department of General Services.

Availability of Funds. Work to be performed under this contract is subject to availability of funds through the State's normal budget process.

Audit Clause. For contracts in excess of \$10,000, the contracting parties shall be subject to the examination and audit of the State Auditor for a period of three years after final payment under the contract. (Government Code Section 8546.7).

Payment Retention Clause. Ten percent of any progress payments that may be provided for under this contract shall be withheld per Public Contract Code Sections 10346 and 10379 pending satisfactory completion of all services under the contract.

Reimbursement Clause. If applicable, travel and per diem expenses to be reimbursed under this contract shall be at the same rates the State provides for unrepresented employees in accordance with the provisions of Title 2, Chapter 3, of the California Code of Regulations. Contractor's designated headquarters for the purpose of computing such expenses shall be: _____

Disabled Veteran Business Enterprise Participation Requirement Audit Clause. Contractor or vendor agrees that the awarding department or its delegates will have the right to review, obtain, and copy all records pertaining to performance of the contract. Contractor or vendor agrees to provide the awarding department or its delegates access to its premises, upon reasonable notice, during normal business hours for the purpose of interviewing employees and inspecting and copying such books, records, accounts, and other material that may be relevant to a matter under investigation for the purpose of determining compliance with Public Contract Code Section 10115 et seq. Contractor or vendor further agrees to maintain such records for a period of three (3) years after final payment under the contract. Title 2 CCR Section 1896.75.

Priority Hiring Considerations. For contracts in excess of \$200,000, the Contractor shall give priority consideration in filling vacancies in positions funded by the contract to qualified recipients of aid under Welfare and Institutions Code Section 11200. (Public Contract Code Section 10353).

Drug-Free Workplace Certification. By signing this contract, the Contractor or grantee hereby certifies under penalty of perjury under the laws of the State of California that the Contractor or grantee will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government Code Section 8350 et seq.) and will provide a drug-free workplace by taking the following actions:

1. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.
2. Establish a Drug-Free Awareness Program to inform employees about all of the following:
 - (a) The dangers of drug abuse in the workplace,
 - (b) The person's or organization's policy of maintaining a drug-free workplace,
 - (c) Any available counseling, rehabilitation and employee assistance programs, and
 - (d) Penalties that may be imposed upon employees for drug abuse violations.
3. Every employee who works on the proposed contract or grant:
 - (a) Will receive a copy of the company's drug-free policy statement, and
 - (b) Will agree to abide by terms of the company's statement as a condition of employment on the contract or grant.

This contract or grant may be subject to suspension of payments or termination, or both, and the Contractor or grantee may be subject to debarment if the department determines that: (1) the Contractor or grantee has made a false certification, or (2) the Contractor or grantee violates the certification by failing to carry out the requirements noted above.

Antitrust Claims. In submitting a bid to a public purchasing body, the bidder offers and agrees that if the bid is accepted, it will assign to the purchasing body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, materials, or services by the bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tenders final payment to the bidder. See Government Code Section 4552.

If an awarding body or public purchasing body received, either through judgment or settlement, a monetary recovery for a cause of action assigned under this chapter, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery. See Government Code Section 4553.

Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under this part if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action. See Government Code Section 4554.

Americans With Disabilities Act. By signing this contract, Contractor assures the state that it complies with the Americans With Disabilities Act (ADA) of 1990, (42 U.S.C. 12101 et seq.), which prohibits discrimination on the basis of disability, as well as all applicable regulations and guidelines issued pursuant to the ADA.

Corporate Qualifications To Do Business in California. Contractor must be currently qualified to do business in California as defined by the Revenue & Taxation Code, Section 23101 unless exempted. Both domestic and foreign corporations (those incorporated outside of California) must be in good standing in order to be qualified to do business in California.

Former State Employees: a) For the two-year period from the date he or she left State employment, no former State officer or employee may enter into a contract in which he or she engaged in any of the negotiations, transactions, planning, arrangements or any part of the decision-making process relevant to the contract while employed in any capacity by any State agency. b) For the twelve-month period from the date he or she left State employment, no former State officer or employee may enter into a contract with any State agency if he or she was employed by that State agency in a policy-making position in the same general subject area as the proposed contract within the twelve-month period prior to his or her leaving State service.

Agreement No. _____

Exhibit _____

ADDITIONAL STANDARD CLAUSES

Recycled Materials. Contractor hereby certifies under penalty of perjury that ____ (enter value or "0" here) percent of the materials, goods and supplies offered or products used in the performance of this Agreement meets or exceeds the minimum percentage of recycled material as defined in Sections 12161 and 12200 of the Public Contract Code.

Severability. If any provision of this Agreement is held invalid or unenforceable by any court of final jurisdiction, it is the intent of the parties that all other provisions of this Agreement be construed to remain fully valid, enforceable, and binding on the parties.

Governing Law. This Agreement is governed by and shall be interpreted in accordance with the laws of the State of California.

Y2K Language. The Contractor warrants and represents that the goods or services sold, leased, or licensed to the State of California, its agencies, or its political subdivisions, pursuant to this Agreement are "Year 2000 compliant." For purposes of this Agreement a good or service is Year 2000 compliant if it will continue to fully function before, at, and after the Year 2000 without interruption and, if applicable, with full ability to accurately and unambiguously process, display, compare, calculate, manipulate, and otherwise utilize date information. This warranty and representation supersedes all warranty disclaimers and limitations and all limitations on liability provided by or through the Contractor.

Child Support Compliance Act. For any Agreement in excess of \$100,000, the Contractor acknowledges in accordance therewith, that:

1. The Contractor recognizes the importance of child and family support obligations and shall fully comply with all applicable state and federal laws relating to child and family support enforcement, including, but not limited to, disclosure of information and compliance with earnings assignment orders, as provided in Chapter 8 (commencing with Section 5200) of Part 5 of Division 9 of the Family Code; and
2. The Contractor, to the best of its knowledge, is fully complying with the earnings assignment orders of all employees and is providing the names of all new employees to the New Hire Registry maintained by the California Employment Development Department.

Agreement No. _____

Exhibit _____

**STANDARD CLAUSES -
INTERAGENCY AGREEMENTS**

Audit Clause. For contracts in excess of \$10,000, the contracting parties shall be subject to the examination and audit of the State Auditor for a period of three years after final payment under the contract. (Government Code Section 8546.7).

Availability of Funds. Work to be performed under this contract is subject to availability of funds through the State's normal budget process.

Interagency Payment Clause. For services provided under this agreement, charges will be computed in accordance with State Administrative Manual Section 8752 and 8752.1.

Termination Clause. Either State agency may terminate this contract upon 30 days advance written notice. The State agency providing the services shall be reimbursed for all reasonable expenses incurred up to the date of termination.

Severability. If any provision of this Agreement is held invalid or unenforceable by any court of final jurisdiction, it is the intent of the parties that all other provisions of this Agreement be construed to remain fully valid, enforceable, and binding on the parties.

Y2K Language. The Contractor warrants and represents that the goods or services sold, leased, or licensed to the State of California, its agencies, or its political subdivisions, pursuant to this Agreement are "Year 2000 compliant" For purposes of this Agreement, a good or service is year 2000 compliant if it will continue to fully function before, at, and after the Year 2000 without interruption and, if applicable, with full ability to accurately and unambiguously process, display, compare, calculate, manipulate, and otherwise utilize date information. This warranty and representation supersedes all warranty disclaimers and limitations and all limitations on liability provided by or through the Contractor.

**STANDARD CLAUSES -
CONTRACTS WITH THE UNITED STATES**

Workers' Compensation Clause. Contractor affirms that it is aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code, and Contractor affirms that it will comply with such provisions before commencing the performance of the work under this contract. This provision shall apply to the extent provided by federal laws, rules and regulations.

Claims Dispute Clause. Any claim that Contractor may have regarding the performance of this agreement including, but not limited to, claims for additional compensation or extension of time, shall be submitted to the Director, Department of Water Resources, within thirty days of its accrual. State and Contractor shall then attempt to negotiate a resolution of such claim and process an amendment to this agreement to implement the terms of any such resolution. However, Contractor does not waive any rights or duties it may have as may be provided by federal laws, rules and regulations.

Nondiscrimination Clause. During the performance of this contract, the recipient, contractor and its subcontractors shall not deny the contract's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, mental disability, medical condition, marital status, age (over 40), or sex. Contractor shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination. Contractor shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.), the regulations promulgated thereunder (California Administrative Code, Title 2, Sections 7285.0 et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code Sections 11135 - 11139.5), and the regulations or standards adopted by the awarding State agency to implement such article. Contractor or recipient shall permit access by representatives of the Department of Fair Employment and Housing and the awarding State agency upon reasonable notice at any time during the normal business hours, but in no case less than 24 hours' notice, to such of its books, records, accounts, other sources of information and its facilities as said Department or Agency shall require to ascertain compliance with this clause. Recipient, Contractor and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. The Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

Availability of Funds. Work to be performed under this contract is subject to availability of funds through the State's normal budget process.

Audit Clause. For contracts in excess of \$10,000, unless otherwise provided by federal laws, rules or regulations, the contracting parties shall be subject to the examination and audit of the State Auditor for a period of three years after final payment under the contract. (Government Code Section 8546.7).

Payment Retention Clause. Ten percent of any progress payments that may be provided for under this contract shall be withheld per Public Contract Code Sections 10346 and 10379 pending satisfactory completion of all services under the contract.

Reimbursement Clause. If applicable, travel and per diem expenses to be reimbursed under this contract shall be at the same rates the State provides for unrepresented employees in accordance with the provisions of Title 2, Chapter 3, of the California Code of Regulations. Contractor's designated headquarters for the purpose of computing such expenses shall be: _____

Americans With Disabilities Act. By signing this contract, Contractor assures the State that it complies with the Americans With Disabilities Act (ADA) of 1990, (42 U.S.C. 12101 et seq.), which prohibits discrimination on the basis of disability, as well as all applicable regulations and guidelines issued pursuant to the ADA.

Conflict of Interest. Current State Employees: a) No State officer or employee shall engage in any employment, activity or enterprise from which the officer or employee receives compensation or has a financial interest and which is sponsored or funded by any State agency, unless the employment, activity or enterprise is required as a condition of regular State employment. b) No State officer or employee shall contract on his or her own behalf as an independent contractor with any State agency to provide goods or services.

Former State Employees: a) For the two-year period from the date he or she left State employment, no former State officer or employee may enter into a contract in which he or she engaged in any of the negotiations, transactions, planning, arrangements or any part of the decision-making process relevant to the contract while employed in any capacity by any State agency. b) For the twelve-month period from the date he or she left State employment, no former State officer or employee may enter into a contract with any State agency if he or she was employed by that State agency in a policy-making position in the same general subject area as the proposed contract within the twelve-month period prior to his or her leaving State service.

**STANDARD CLAUSES -
GENERAL CONDITIONS FOR PUBLIC WORKS CONTRACTS**

LICENSE. No bidder may bid on work for which it is not properly licensed by the Contractor's State License Board. Joint Venture bidders must possess a Joint Venture License. Bidders for this Agreement must have _____ classification(s) of contractor's license, provide license number and expiration date and certify under penalty of perjury that the foregoing is true and correct.

EXAMINATION OF BID DOCUMENTS AND SITE. Bidder shall carefully examine site of work, plans and specifications. The bidder shall investigate conditions, character, quality of surface, or subsurface materials or obstacles to be encountered. No additions to the contract amount will be made because of the Contractor's failure to examine the site of work, plans and specifications.

SUBCONTRACTORS. (See Public Contract Code Section 4104.) The bidder shall set forth in its bid:

- a. The name and business address of each subcontractor who will perform work or labor or render services in an amount in excess of one-half of one percent (.5%) of the General Contractor's total bid; and
- b. The portion of work to be done by each subcontractor. (See Public Contract Code Section 4104.)

PAYMENT BOND. The Contractor shall furnish, concurrently with signing the contract, a Payment Bond to Accompany Construction Contract, Standard Form 807, in an amount not less than fifty percent (50%) of the amount of the contract when its bid exceeds \$5000. Such bond shall be executed by the Contractor and a corporate surety approved by the State.

WORKERS' COMPENSATION INSURANCE CERTIFICATION. Upon execution of the contract, the Contractor shall provide the State either with a certificate of insurance issued by an insurance carrier licensed to write workers' compensation insurance in the State of California, including the name of the carrier and date of expiration of the insurance, or a certificate of consent to self-insure issued by the Director of the Department of Industrial Relations.

PREVAILING WAGE. It is hereby mutually agreed that the Contractor shall forfeit to the State a penalty of \$50 for each calendar day, or portion thereof, for each worker paid by it, or subcontractor under it, less than the prevailing wage so stipulated. In addition the Contractor further agrees to pay to each worker the difference between the actual amount paid for each calendar day, or portion thereof, and the stipulated prevailing wage rate for the same. This provision shall not apply to properly registered apprentices.

MAXIMUM HOURS. It is further agreed that the maximum hours a worker is to be employed is limited to 8 hours a day and 40 hours a week and the Contractor shall forfeit, as a penalty to the State, \$25 for each worker employed in the execution of the contract for each calendar day during which a worker is required or permitted to labor more than 8 hours in any calendar day or more than 40 hours in any calendar week in violation of Labor Code Sections 1810-1815, inclusive.

TRAVEL AND SUBSISTENCE PAYMENTS. Travel and subsistence payments shall be paid to each worker needed to execute the work, as such travel and subsistence payments are defined in the applicable collective bargaining agreements filed in accordance with Labor Code Section 1773.8.

APPRENTICES. Properly registered apprentices may be employed in the prosecution of the work. Every such apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he or she is employed, and shall be employed only at the work of the craft or trade to which he or she is registered. The Contractor and each subcontractor must comply with the requirements of Labor Code Section 1777.5 and any related regulations regarding the employment of registered apprentices.

SUBSTITUTIONS. Pursuant to Section 3400 of the Public Contract Code, should the Contractor seek to substitute a brand of materials other than specified, the Contractor shall submit data substantiating the request for substitution of "an equal" item. The substantiating data must be presented for approval within thirty-five (35) days after the award of the agreement. The State shall be the sole judge as to the comparative quality and suitability of "an equal" item.

ANTI-TRUST CLAIMS. The Contractor offers and agrees and will require all of his subcontractors and suppliers to agree to assign to the awarding body all rights, title, and interest in and to all causes of action they may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Sec. 165700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials, pursuant to the public works contract or the subcontract. The assignment made by the Contractor and all additional assignments made by the subcontractors and suppliers shall be deemed to have been made and will become effective at the time the awarding body tenders final payment to the Contractor, without further acknowledgment or the necessity of tendering to the awarding body any written assignments.

If an awarding body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under Government Code Sections 4550-4554, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery.

Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under Government Code Sections 4550-4554, if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action.

PROGRESS PAYMENTS

- a. Ten percent of any progress payments that may be provided for under this contract shall be withheld pending satisfactory completion of all services under the contract. The Contractor may substitute securities for such retentions and receive any interest accrued provided in Section 22300 of the Public Contract Code.
- b. No progress payments shall be made unless the Contractor, upon execution of the contract, furnishes a faithful performance bond for not less than one-half the total amount payable under the contract.

PAYROLL RECORDS. The Contractor and each subcontractor shall comply with Labor Code Section 1776 regarding payroll records.

NONCOLLUSION AFFIDAVIT. All bidders shall submit with their bids a signed and notarized Noncollusion Affidavit (DWR 4206).

LABOR CODE PROVISIONS. Pursuant to Sections 1770 et seq. of the California Labor Code, the Director of the State Department of Industrial Relations has made the general prevailing wage determination covering the locality where work for this contract is to be performed. A copy of the publication **General Prevailing Wage Rates** is on file for inspection at the State Department of Water Resources, Contract Services Office, 1416 Ninth Street, Sacramento, CA.

The Contractor agrees to post a copy of the **General Prevailing Wage Determination** for the locality of each job site. The Contractor also agrees to comply with all requirements of the California Labor Code and to pay the forfeiture penalties and monies which may become due as provided in Sections 1775 and 1813 of that Code.

UNDOCUMENTED ALIENS. No bidder or Contractor shall be eligible to bid for or receive a public works or purchase contract, who has, in the preceding five years, been convicted of violating a State or federal law respecting the employment of undocumented aliens.

Agreement No. _____

Exhibit _____

**STANDARD CLAUSES -
INSURANCE REQUIREMENTS**

Contractor shall furnish to the State a certificate of insurance stating that here is liability insurance presently in effect for the contractor of not less than \$1,000,000 per occurrence for bodily injury and property damage liability combined.

The certificate of insurance must include the following provisions:

1. The insurer will not cancel the insured's coverage without 30 days' prior written notice to the State.
2. The State of California, its officers, agents, employees, and servants are included as additional insured, but only in so far as the operation under this contract are concerned.

Contractor agrees that the bodily injury liability insurance herein provided for shall be in effect at all times during the term of this contract. In the event said insurance coverage expires at any time or times during the term of this contract, contractor agrees to provide at least thirty (30) days prior to said expiration date, a new certificate of insurance evidencing insurance coverage as provided for herein for not less than the remainder of the term of the contract, or for a period of not less than one (1) year. New certificates of insurance are subject to the approval of the Department of General Services and contractor agrees that no work or services shall be performed prior to the giving of such approval. In the event contractor fails to keep in effect at all times insurance coverage as herein provided, State may, in addition to any other remedies it may have, terminate this contract upon the occurrence of such event.

Insurance certificates must have an original signature.

**STANDARD CALIFORNIA NONDISCRIMINATION
CONSTRUCTION CONTRACT SPECIFICATIONS
(GOVERNMENT CODE, SECTION 12990)**

STD 18 (REV. 1-95) PNC

These specifications are applicable to all state contractors and subcontractors having a construction contract or subcontract of \$5,000 or more.

1. As used in the specifications:
 - a. **"Administrator"** means Administrator, Office of Compliance Programs, California Department of Fair Employment and Housing (DFEH), or any person to whom the Administrator delegates authority;
 - b. **"Minority"** includes:
 - (i) **Black** (all persons having primary origins in any of the black racial groups of Africa, but not of Hispanic origin);
 - (ii) **Hispanic** (all persons of primary culture or origin in Mexico, Puerto Rico, Cuba, Central or South America or other Spanish derived culture or origin regardless of race);
 - (iii) **Asian/Pacific Islander** (all persons having primary origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent or the Pacific Islands); and
 - (iv) **American Indian/Alaskan Native** (all persons having primary origins in any of the original peoples of North America and who maintain culture identification through tribal affiliation or community recognition).
2. Whenever the contractor or any subcontractor subcontracts a portion of the work, it shall physically include in each subcontract of \$5,000 or more the nondiscrimination clause in this contract directly or through incorporation by reference. Any subcontract for work involving a construction trade shall also include the Standard California Construction Contract Specifications, either directly or through incorporation by reference. Any subcontract for work involving a construction trade shall also include the Standard California Construction Contract Specifications, either directly or through incorporation by reference.
3. The contractor shall implement the specific nondiscrimination standards provided in paragraphs 6(a) through (e) of these specifications.
4. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the contractor's obligations under these specifications, Government Code, Section 12990, or the regulations promulgated pursuant thereto.
5. In order for the nonworking training hours of apprentices and trainees to be counted, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor or the California Department of Industrial Relations.
6. The contractor shall take specific actions to implement its nondiscrimination program. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor must be able to demonstrate fully its efforts under Steps a. through e. below:
 - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and at all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all leadpersons, superintendents, and other on-site supervisory personnel are aware of and carry out the contractor's obligations to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b. Provide written notification within seven days to the director of DFEH when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
 - c. Disseminate the Contractor's equal employment opportunity policy by providing notice of the policy to unions and training, recruitment and outreach programs and requesting their cooperation in assisting the Contractor to meet its obligations; and by posting the company policy on bulletin boards accessible to all employees at each location where construction work is performed.

(Continue on reverse)

**STANDARD CALIFORNIA NONDISCRIMINATION
CONSTRUCTION CONTRACT SPECIFICATIONS
(GOVERNMENT CODE, SECTION 12990)**

STD. 18 (REV. 1-85) (REVERSE) MC

- d. Ensure all personnel making management and employment decisions regarding hiring, assignment, layoff, termination, conditions of work, training, rates of pay or other employment decisions, including all supervisory personnel, superintendents, general leadpersons, on-site leadpersons, etc., are aware of the Contractor's equal employment opportunity policy and obligations, and discharge their responsibilities accordingly.
 - e. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the equal employment opportunity policy and the Contractor's obligations under these specifications are being carried out.
7. Contractors are encouraged to participate in voluntary associations which assist in fulfilling their equal employment opportunity obligations. The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's.
 8. The Contractor is required to provide equal employment opportunity for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of the Fair Employment and Housing Act (Gov. Code Section 12990 et seq.) if a particular group is employed in a substantially disparate manner.
 9. Establishment and implementation of a bona fide affirmative action plan pursuant to Section 8104(b) of this Chapter shall create a rebuttable presumption that a contractor is in compliance with the requirements of Section 12990 of the Government Code and its implementing regulations.
 10. The Contractor shall not use the nondiscrimination standards to discriminate, harass or allow harassment against any person because of race, color, religious creed, sex, national origin, ancestry, disability (including HIV and AIDS), medical condition (cancer), age, marital status, or denial of family and medical care leave and denial of pregnancy disability leave.
 11. The Contractor shall not enter into any subcontract with any person or firm decertified from state contracts pursuant to Government Code Section 12990.
 12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and the nondiscrimination clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Government Code Section 12990 and its implementing regulations by the awarding agency. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Government Code Section 12990.
 13. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company equal employment opportunity policy is being carried out, to submit reports relating to the provisions hereof as may be required by OCP and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status, (e.g., mechanic, apprentice trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in any easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

BIDDER'S BOND

We _____

 _____, as PRINCIPAL, and

as SURETY, are held and firmly bound unto the State of California in the penal sum of TEN PERCENT (10%) OF THE TOTAL AMOUNT OF THE BID of the Principal above named submitted by said Principal to the State of California, acting by and through the Department of Water Resources, for the work described below, for the payment of which sum in lawful money of the United States, well and truly to be made, to the Director of the Department to which said bid was submitted, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

In no case shall the liability of the surety here under exceed the sum of \$ _____.

THE CONDITION OF THIS OBLIGATION IS SUCH,

That whereas the Principal has submitted the above-mentioned bid to the State of California, as aforesaid, for certain construction specifically described as follows, for which bids are to be opened at

_____, California, on _____
(Insert name of city where bids will be opened) (Insert date of bid opening)
 for _____

Copy here the exact description of work, including location, as it appears on the proposal)

NOW, THEREFORE, If the aforesaid Principal is awarded the contract and, within the time and manner required under the specifications, after the prescribed forms are presented to him for signature, enters into a written contract, in the prescribed form, in accordance with the bid, and files two bonds with the Department, one to guarantee faithful performance and the other to guarantee payment for labor materials, as required by law, then this obligation shall be null and void; otherwise, it shall be and remain in full force and virtue.

IN WITNESS WHEREOF, We have hereunto set our hands and seals on this _____
 day of _____, 19 ____.

 _____ (Seal)
 _____ (Seal)
 _____ (Seal)
 Principal
 _____ (Seal)
 _____ (Seal)
 _____ (Seal)
 Surety

Address _____

NOTE: Signatures of those executing for the surety must be properly acknowledged.

NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 19 (REV. 3-95) PMC

COMPANY NAME

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME

Fay Yee

Contract & Grant Analyst

DATE EXECUTED

APR 14 1999

EXECUTED IN THE COUNTY OF

Yolo

PROSPECTIVE CONTRACTOR'S SIGNATURE

PROSPECTIVE CONTRACTOR'S TITLE

Fay Yee

Contract & Grant Analyst

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA

PAYMENT BOND TO ACCOMPANY CONSTRUCTION CONTRACT
(CIVIL CODE SECTION 3247)

The premium on this bond is _____ for the term _____ BOND NO. _____

Know All Men By These Presents:

That The State of California, acting by and through the _____
has awarded to _____ (CONTRACTOR / PRINCIPLE) whose address is _____
as Principle, a contract for the work described as follows:

WHEREAS, The provisions of Civil Code Section 3247 require that the Principle file a bond in connection with said contract and this bond is executed and tendered in accordance therewith.

NOW THEREFORE, Principle and _____, a corporation organized under the laws of _____ (SURETY), and authorized to transact a general surety business in the State of California, as Surety, are held and firmly bound to the People of the State of California in the penal sum of _____ (\$ _____), for which payment we bind ourselves, our heirs, executors, administrators, successors and assigns jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH,

1. That if said Principle or its subcontractors shall fail to pay any of the persons named in Civil Code Section 3181, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Principle and subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to such work and labor, that the Surety herein will pay for the same, otherwise this obligation is to be void. In case suit is brought upon this bond, the Surety will pay a reasonable attorney's fee to be fixed by the court.

2. This bond shall insure to the benefit of any persons named in Civil Code Section 3181 as to give a right of action to such persons or their assigns in any suit brought upon this bond.

3. The aggregate liability of the Surety hereunder, including costs and attorney fees, on all claims whatsoever shall not exceed the penal sum of the bond in accordance with the provisions of Section 996.470(a) of the Code of Civil Procedure.

4. This bond is executed by the Surety, to comply with the provisions of Chapter 7, Title 15, Part 4, Division 3 of the Civil Code and of Chapter 2, Title 14, Part 2 of the Code of Civil Procedure and said bond shall be subject to all of the terms and provisions thereof.

5. This bond may be cancelled by the Surety in accordance with the provisions of Section 996.310 et seq. of the Code of Civil Procedure.

6. This bond to become effective _____

(NAME OF SURETY)

(ADDRESS)

I certify (or declare) under penalty of perjury that I have executed the foregoing bond under an unrevoked power of attorney.

Executed in _____ (CITY AND STATE) on _____ (DATE)

under the laws of the State of California.

(SIGNATURE OF ATTORNEY IN FACT)

(PRINTED OR TYPED NAME OF ATTORNEY IN FACT)

PERFORMANCE BOND TO ACCOMPANY CONTRACT

WHEREAS, The State of California acting by and through the

(insert name of the Department awarding the contract)

, has awarded

to

as principal hereinafter designated as the "Contractor," a contract for

AND WHEREAS, The Contractor is required to furnish a bond in connection with said contract guaranteeing the faithful performance thereof;

NOW, THEREFORE, We the undersigned Contractor and surety are held and firmly bound unto the State of California in the sum of

dollars

(\$), to be paid to the said State or its certain attorney, its successors and assigns; for which payment, well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors or assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH,

That if the Contractor, his or its heirs, executors and administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the foregoing contract and any alteration thereof made as therein provided, on his or its part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the State of California, its officers and agents, as therein stipulated, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and effect.

IN WITNESS WHEREOF, We have hereto set our hands and seals on this

day of 19

[Seal]

[Seal]

Contractor

[Seal]

[Seal]

Name of Surety

[Seal]

By

Attorney-in-Fact

[Seal]

NOTE: Signatures of those executing for surety must be properly acknowledged.

**NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY
BIDDER AND SUBMITTED WITH BID FOR PUBLIC WORKS**

STATE OF CALIFORNIA)
)ss
COUNTY OF _____)

_____, being first duly sworn, deposes and
(name)
says that he or she is _____ of
(position title)

(the bidder)

the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

DATED: _____

By _____
(person signing for bidder)

Subscribed and sworn to before me on

(Notary Public)

(Notarial Seal)

**STANDARD CLAUSES --
SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER**

NOTICE TO ALL BIDDERS:

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 1896, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-5060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

_____ Yes* _____ No

*Attach a copy of your certification approval letter.

Attachment E
Terms and Conditions for Federal (Department of Interior) Funds

U.S. Department of the Interior

**Certifications Regarding Debarment, Suspension and
Other Responsibility Matters, Drug-Free Workplace
Requirements and Lobbying**

Persons signing this form should refer to the regulations referenced below for complete instructions:

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used; use this form for certification and sign; or use Department of the Interior Form 1954 (DI-1954). (See Appendix A of Subpart D of 43 CFR Part 12.)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)

Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12)

Signature on this form provides for compliance with certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

**PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters -
Primary Covered Transactions**

CHECK ☐ IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE.

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

**PART B: Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -
Lower Tier Covered Transactions**

CHECK ☐ IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE.

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

01-2011
March 1995
This form parallels OI-1952, OI-1954,
OI-1955, OI-1956 and OI-1963.

PART C: Certification Regarding Drug-Free Workplace Requirements

CHECK ☐ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS NOT AN INDIVIDUAL.

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it will or continue to provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing an ongoing drug-free awareness program to inform employees about--
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will --
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;
- (e) Notifying the agency in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification numbers(s) of each affected grant;
- (f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted --
 - (1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a) (b), (c), (d), (e) and (f).

B. The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

Institute of Toxicology & Environmental Health

University of California, Old Davis Road

Davis, CA 95616-8615

YOLO COUNTY

Check ☐ if there are workplaces on file that are not identified here.

PART D: Certification Regarding Drug-Free Workplace Requirements

CHECK ☐ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS AN INDIVIDUAL.

Alternate II. (Grantees Who Are Individuals)

- (a) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant;
- (b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to the grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

PART E: Certification Regarding Lobbying
Certification for Contracts, Grants, Loans, and Cooperative Agreements

CHECK ☐ IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND
THE AMOUNT EXCEEDS \$100,000: A FEDERAL GRANT OR COOPERATIVE AGREEMENT;
SUBCONTRACT, OR SUBGRANT UNDER THE GRANT OR COOPERATIVE AGREEMENT.

CHECK ☒ IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL
LOAN EXCEEDING THE AMOUNT OF \$150,000, OR A SUBGRANT OR
SUBCONTRACT EXCEEDING \$100,000, UNDER THE LOAN.

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL

Fay Yee

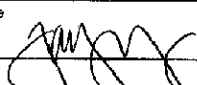
TYPED NAME AND TITLE

Contract & Grant Analyst

DATE

APR 14 1999

APPLICATION FOR FEDERAL ASSISTANCE

1. TYPE OF SUBMISSION Application <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Non-Construction		2. DATE SUBMITTED April 12, 1999		Applicant Identifier	
Preapplication <input type="checkbox"/> Construction <input type="checkbox"/> Non-Construction		3. DATE RECEIVED BY STATE		State Applicant Identifier	
		4. DATE RECEIVED BY FEDERAL AGENCY		Federal Identifier	
5. APPLICANT INFORMATION					
Legal Name: The Regents of the University of California			Organizational Unit: Institute of Toxicology & Environmental Health		
Address (give city, county, state, and zip code): University of California, Davis Office of Vice Chancellor Research, 1 Shields Avenue Davis, CA 95616 Yolo County			Name and telephone number of the person to be contacted on matters involving this application (give area code): Technical: Marti Wolfe, (530) 754-8536 Administrative/Budgetary: Fay Yee, (530) 752-2075		
6. EMPLOYER IDENTIFICATION NUMBER (EIN): 9 4 - 6 0 3 6 4 9 4			7. TYPE OF APPLICANT: (enter appropriate letter in box) I A. State B. County C. Municipal D. Township E. Interstate F. Intermunicipal G. Special District H. Independent School Dist. I. State Controlled Institution of Higher Learning J. Private University K. Indian Tribe L. Individual M. Profit Organization N. Other (Specify) _____		
8. TYPE OF APPLICATION: <input checked="" type="checkbox"/> New <input type="checkbox"/> Continuation <input type="checkbox"/> Revision If Revision, enter appropriate letter(s) in box(es): <input type="checkbox"/> <input type="checkbox"/> A. Increase Award B. Decrease Award C. Increase Duration D. Decrease Duration Other (specify): _____			9. NAME OF FEDERAL AGENCY: CALFED BAY-DELTA PROGRAM		
10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: TITLE: _____			11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: Impacts of Dietary Selenium on Giant Garter Snake Populations in the Sacramento-San Joaquin Watershed		
12. AREAS AFFECTED BY PROJECT (cities, counties, states, etc.): Merced County					
13. PROPOSED PROJECT: Start Date: 07/01/99 Ending Date: 03/31/02		14. CONGRESSIONAL DISTRICTS OF: a. Applicant: 3rd b. Project: 3rd			
15. ESTIMATED FUNDING:		16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?			
a. Federal	\$ 266,850.00	a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON: DATE _____			
b. Applicant	\$.00	b. NO. <input type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372			
c. State	\$.00	<input type="checkbox"/> OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW			
d. Local	\$.00				
e. Other	\$.00				
f. Program Income	\$.00	17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?			
g. TOTAL	\$.00	<input type="checkbox"/> Yes If "Yes," attach an explanation. <input checked="" type="checkbox"/> No			
18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT. THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.					
a. Typed Name of Authorized Representative Fay Yee			b. Title Contract & Grant Analyst		c. Telephone number (530) 752-2075
d. Signature of Authorized Representative 					e. Date Signed Apr 14 1999

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I - 0 1 8 8 7 7

I-018877

BUDGET INFORMATION --Non Construction Programs**SECTION A - BUDGET SUMMARY**

Grant Program Function of Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Total (g)	Non-Federal (f)	Federal (e)
1. Research		\$544,698	\$	\$544,698	\$	\$544,698
2.						
3.						
4.						
5. TOTALS		\$544,698	\$	\$544,698	\$	\$544,698

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	07/01/99-6/30/00	07/01/00-6/30/01	07/01/01-3/31/02	(4)	
a. Personnel	\$ 43,855	\$ 45,123	\$ 7,222		\$ 96,200
b. Fringe Benefits	5,748	5,985	3,008		14,741
c. Travel	1,000	1,000	2,000		4,000
d. Equipment	31,500				
e. Supplies	9,430	15,130	5,300		29,860
f. Contractual	136,442	139,717	5,459		281,618
g. Construction					
h. Other	12,096	13,396	6,856		32,348
i. Total Direct Charges (sum of 6a-6h)	240,071	220,351	45,246		505,668
j. Indirect Charges	17,513	14,700	6,817		39,030
k. TOTALS (sum of 6i and 6j)	\$257,584	\$235,051	\$52,063		\$544,698
7. Program Income	\$	\$	\$	\$	\$

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SECTION C - NON-FEDERAL RESOURCES					
(a) Grant Program		(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.		\$	\$	\$	\$
9.					
10.					
11.					
12. TOTALS (sum of lines 8 and 11)		\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS						
		Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal		\$257,584	\$64,396	\$64,396	\$64,396	\$64,396
14. Non-Federal						
15. TOTAL (sum of lines 13 and 14)		\$257,584	\$64,396	\$64,396	\$64,396	\$64,396

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEED FOR BALANCE OF THE PROJECT					
(a) Grant Program		FUTURE FUNDING PERIODS (Years)			
		(b) First	(c) Second	(d) Third	(e) Fourth
16.					
17.					
18.					
19.					
20. TOTALS (sum of lines 16-19)		\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION (Attach Additional Sheets if Necessary)	
21. Direct Charges:	22. Indirect Charges: \$ 39,030 MTDC
23. Remarks If funded by "Federal" Our DHHS Federally Negotiated Indirect Cost Rate is 18.9% for Year One and 19.3% for Year Two and Three	

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ASSURANCES - NON-CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

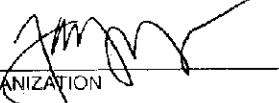
PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. Those requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 		TITLE Fay Yee Contract & Grant Analyst	
APPLICANT ORGANIZATION THE REGENTS OF THE UNIVERSITY OF CALIFORNIA		DATE SUBMITTED APR 14 1999	

Standard Form 424B (Rev. 7-97) Back

ASSURANCES -- CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0042), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET, SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the Awarding Agency. Further, certain Federal assistance awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant I certify that the applicant:

1. Has the legal authority to apply for Federal assistance, and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States, and if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the assistance; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will not dispose of, modify the use of, or change the terms of the real property title, or other interest in the site and facilities without permission and instructions from the awarding agency. Will record the Federal interest in the title of real property in accordance with awarding agency directives and will include a covenant in the title of real property acquired in whole or in part with Federal assistance funds to assure non-discrimination during the useful life of the project.
4. Will comply with the requirements of the assistance awarding agency with regard to the drafting, review and approval of construction plans and specifications.
5. Will provide and maintain competent and adequate engineering supervision at the construction site to ensure that the complete work conforms with the approved plans and specifications and will furnish progress reports and such other information as may be required by the assistance awarding agency or State.
6. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
7. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
8. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. Secs. 4728-4763) relating to prescribed standards for merit systems for programs funded under one of the nineteen statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
9. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. Secs. 4801 et seq.) which prohibits the use of lead based paint in construction or rehabilitation of residence structures.
10. Will comply with all Federal statutes relating to non-discrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. Secs. 1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. Secs. 794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. Secs. 6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) Secs. 523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. Secs. 3601 et seq.), as amended, relating to non-discrimination in the sale, rental or financing of housing; (i) any other non-discrimination provisions in the specific statute(s) under which application for Federal assistance is being made, and (j) the requirements of any other non-discrimination Statute(s) which may apply to the application.

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Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provides for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal and federally assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

Will comply with the provisions of the Hatch Act (5 U.S.C. Secs. 1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. Secs. 276a to 276a - 7), the Copeland Act (40 U.S.C. Secs. 276c and 18 U.S.C. Sec. 874), the Contract Work Hours and Safety Standards Act (40 U.S.C. Secs. 327-333), regarding labor standards for federally assisted construction subagreements.

Will comply with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.

Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the

National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. Secs. 1451 et seq.); (f) conformity of Federal actions to State (Clear Air) Implementation Plans under Section 176(c) of the Clear Air Act of 1955, as amended (42 U.S.C. Secs. 7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended, (P.L. 93-523); and (h) protection of endangered species under the Endangered Species Act of 1973, as amended, (P.L. 93-205).

16. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. Secs. 1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
17. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec. 470), EQ 11593 (identification and preservation of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469a-1 et seq.).
18. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act of 1984.
19. Will comply with all applicable requirements of all other Federal laws, Executive Orders, regulations and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL

TITLE

Fay Yee
Contract & Grant Analyst

APPLICANT ORGANIZATION

THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA

DATE SUBMITTED

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